

# Teaching Guide for

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# Our Number Workshop

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**Scott, Foresman and Company**

Chicago, Atlanta, Dallas, Palo Alto, Fair Lawn, N.J.

CURRICULUM FOUNDATION SERIES

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## INTRODUCTION

### The Purpose of This "Teaching Guide"

It is important to remember that *Our Number Workshop 1* is designed to give the child an opportunity to apply number ideas and to get experience in using these ideas. Two things must be done before the child can be expected to do the work on the worksheets: (1) the child must be taught the concepts and ideas to be used, and (2) the child must be fully instructed on the procedures required for responding to the exercises on the worksheets.

If *Our Number Workshop 1* is used in connection with *Numbers We See*, no further teaching of the number concepts is necessary. The teacher need only make certain that all the children understand exactly what they are to do on each worksheet and how they are to make their responses. For each worksheet a brief statement is given of the concepts involved, of the method of presenting the exercise, and of the response required.

For the convenience of teachers using *Our Number Workshop 1* without *Numbers We See*, this *Teaching Guide* gives specific instructions for teaching the concepts the children will need before they attempt to do the exercises in *Our Number Workshop 1*. For each section of worksheets (for example, 1-3, "Many-few"), a brief statement of the concepts involved is given under the heading "Objectives"; general suggestions for teaching are given under "Preliminary Teaching"; and detailed instructions for each page are given under "Comments." Also included for each worksheet are brief notes for teaching and a reproduction of the page, to which the notes are keyed. Answers are shown on the reproduced pages.

(Continued on page 96)

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## 1-3 MANY-FEW

### Objectives

General ideas of *many* and *few* should precede the precise ideas of number which the child must acquire. Before he can answer the question "How many?" crude ideas of differences in quantity must be established. He must be able to recognize without counting whether a group has *many* or *few* members and must understand that these ideas are relative. *Many* objects in one situation may be thought of as *few* objects in another situation. His first step toward the comprehension of numerosity is to develop intuitive reactions to *many* and *few* without counting. Worksheets 1, 2, and 3 present the ideas of *many* and *few*.

### Preliminary Teaching

Before using Worksheets 1, 2, and 3, discuss informally the general ideas of *many* and *few*. Ask the children to name things in the classroom, at home, and out of doors that make them think of *many*. If they have difficulty, help them by suggesting the stars in the sky, the windows in a large building, the cans of food in a store, or all the desks in the classroom. Give each child a chance to name some things that mean *many* to him and to explain the reasons for his choice.

When you are sure that all the children have a clear understanding of the word *many*, ask them questions about things that are not many. "If almost all the leaves fell off a tree in winter, would the tree have many leaves left?" Ask such questions until they use the word *few*. Then ask them to name things that make them think of "just a few." Let each child name at least one thing and explain why it means *few* to him.

[Worksheet 1 can be used at this point. Comments and keyed notes are

provided for Worksheet 1 on pages 1 and 3.]

Give the children an opportunity to express their ideas of what *many* and *few* mean to them by having each child bring to school two pictures cut from old magazines, one of which shows *many* and the other *few*. All children should take part in the discussion of these pictures. Encourage them to express differences of opinion as to whether the pictures show *many* or *few*, and have them explain the reasons for their decisions.

[Worksheet 2 can be used at this point. Comments and keyed notes are provided on pages 2 and 4.]

Next, activities should be planned to help the children see that use or situation may determine whether a certain collection of things is *many* or *few*. Say, "If the desks in this room had to be used by all the children in the school, would you think of the desks as *many* or *few*? If all the children in this room except Tom and Mary and Diane went out to the playground, would there be *many* or *few* desks for those three children? If you had a big basket full of apples at home, would there be many apples or few apples? If the same basket were in an orchard of many apple trees, and each tree had lots of apples on it, would the apples in the basket be *many* or *few*?" After the children have responded to such questions, let them take turns making up questions and asking other members of the group to answer them. Encourage the children to discuss the relative use of *many* and *few* in as many ways as you can until you are sure they understand.

[Worksheet 3 may be used at this point.]

## 1 Comments

On this page the child is introduced to the ideas of *many* and *few* and uses

judgment to distinguish between groups containing many objects and groups containing few objects.

The first two of the five response symbols that are used throughout *Our Number Workshop 1* are introduced on this page. They are ●, used to show *many*, *most*, *taller*, *tallest*, *largest*, *greatest quantity*, etc., and ○, used to show *few*, *less*, *shorter*, *shortest*, *smallest*, *least quantity*, etc. These marks should be shown to the children and their use explained while the page is being explained.

The children should be allowed to look at the page and discuss it freely for a few minutes before they are told what to do with it. After they have had a chance to comment on the contents of the page, the ideas of *many-few* can be established by several such questions as: "What do you see many of in the picture? Do you see only one of anything? Is one many or few?" etc.

Put the mark ● on the board and tell the children it means *many*. Point out that it is heavy and solid, and has to be filled in with pencil. Then put the mark ○ on the board and tell them it means *few*. Point out that this mark is open and easy to make. Get them to see that each mark suggests its meaning by the effort or work needed to make it. The children are not required to make the response marks on this worksheet, but have them practice making the marks on a sheet of paper.

For each group of children or things in the large picture, there is a small picture at the bottom of the page. In each small picture there is a single object from the group and two small red squares, one with the symbol for *many* and one with the symbol for *few*. The children are to look at a small picture, then find the group it represents in the large picture and decide whether there are many or few

objects in it. Then they are to draw a line from the object in the small picture to the red response square with the symbol that shows what they decided. For example, when they decide there are many puppies, they are to draw a line from the puppy in the small picture to the red square with the solid black circle in it. The method of responding should be carefully explained to the children before they begin to work on the page.

A group of bright children will be able to finish the work on the page independently after you have worked through the first two small pictures with them. Slow learners will need help with most, if not all, of the page.

Evaluation of this page, and of others where the responses are somewhat subjective, should be made on the basis of the child's understanding of the number idea involved, and his work should be considered correct if he can justify his decisions and use correct response symbols to indicate them. It should not be expected that in every case the decisions of the children will be the same. When there are differences in responses, a general discussion will help to broaden the meaning of the concept for the children.

## 2

### Comments

On this page the child continues to make judgments about quantity as expressed in the ideas of *many* and *few* and responds by making the marks learned on the previous page.

Introduce the page by placing before the children a flannel board with many little pictures of animals on it and a red response square in the lower corner like the squares on the page. A flannel board may be made by covering an 18" x 24" piece of easel-board or other heavy cardboard with felt or flannel, preferably in a

dark color. The pictures of animals may be cut from magazines. A small piece of sandpaper pasted on the back of each picture will hold it to the flannel board. Prepare several red squares, but demonstrate both response marks on the chalkboard before you begin the work with the flannel board. Place the flannel board in front of the group, and tell the children that it is just like the first picture on page 2 except that there is no little boy in it. Ask the children if they think there are many animals or few animals. (Be sure to have many animals.) When they decide that there are many, show them how to make a solid circle in the red square. Remind them that this mark means *many*. Then have them look at their books, and ask them whether they think the little boy in the first picture has many or few toy animals. Tell them to make a mark for *many* in the red square, just like the one you showed on the flannel board. Look at all the books to see that the children have made their marks correctly. Next, remove most of the animals from the flannel board, so that fewer remain, and put a new red square in the corner. Ask the children if there are many or few animals there now. Help them decide there are few, and show them how to make the mark for *few* in the red square.

Direct attention to the second picture on the page and ask the children whether they think the little girl has many apples or few apples. Let them discuss the picture for a few minutes, then tell them to write in the red square the response mark that shows what they have decided. Most groups will be able to complete the page independently. Slow learners might need help with all three pictures at the top of the page, but they should be able to do the rest of the work by themselves.

After the children have finished, let them discuss their answers. Be sure they can justify their decisions, but accept any answer as long as the child has a reason for his decision and can explain it. It is important that the children understand that *many* and *few* do not describe definite quantities, but that several different ideas of what constitutes many and what constitutes few may be correct.

The same criteria that were used to evaluate Worksheet 1 may be used to evaluate the children's work on this page. The child should understand the ideas of *many* and *few* and have a reason for each decision he makes.

## 3

### Comments

On this page the relative aspects of *many* and *few* are emphasized. The child is made aware that *many* objects in one situation may be interpreted as *few* in another situation, and that both environment and experience influence quantitative judgment.

By using each picture to represent two different situations (in the city and in the country), the children learn that judgments of *many-few* are relative. It should be pointed out to the children that things that are abundant in one place may be scarce in another. For example, cows are common in dairy-farming country and scarce on city streets. Before beginning work on this page, let the children suggest and discuss things that are considered *many* in one situation and *few* in another. Gradually bring the discussion around to the differences between the city and the country. If there are any children in the class who have never been to the country, be sure they understand that cows, birds, pumpkins, etc. are found there in large numbers. Continue the discussion until you are sure that the children have a good idea of the kinds of things

that are found in the city and in the country and of the ways in which the two environments differ.

The children are to think of each picture in two ways: as if it were a scene in the city and as if it were a scene in the country. The red barn in the upper left corner of each picture on the page stands for the country, and the red skyscraper in the lower right corner of each picture stands for the city. The children are to write their responses on these symbols. Before asking them to write their responses, make the two marks, ● for many and ○ for few, on the chalkboard and remind them of the meaning of each mark. Leave the marks on the board so that the children can use them for further reference if they need to.

The responses should be checked by the children themselves, after a

discussion of how various children have responded and the reasons for their answers. Evaluation should be based on the child's understanding of the concept of *many-few* and his ability to explain his decisions. The responses shown on the reproduced worksheet are merely those that most children might be expected to make. Under certain circumstances each of them could be challenged.

If you are working with a slow group, it may be necessary to discuss several of the pictures on the page with the children before they are able to work alone. It may also be necessary to spend two arithmetic periods on this exercise. Most average or able groups, however, could probably complete both parts of the exercise within one period.

If you use two periods for this work, let the children compare and discuss

their answers on the second day. This discussion should bring out that there are no right answers for some of the pictures on the page and that for many of the pictures the answer is one thing for the country and its opposite for the city.

# 1

1 Ask the children to find in the big picture a group of objects like the one here.

2 Have them decide whether there are many or few puppies in the group. If they think there are many puppies, they are to draw a line from the puppy in the small picture to the red square with the mark ● in it. If they think there are few puppies, they are to draw a line from the red square with the mark ○ on it.

3 Use the same procedure with the second small picture and the group of girls in the large picture.

4 Have the children finish the page independently. When they have finished, let them discuss their decisions and give their reasons.



# 2



1 Draw a square on the chalkboard. Then ask the children if the boy in the first picture has many or few toys. Help them to decide that he has many toys. Show them how to make the mark ● in the square. Explain that it means *many*.

2 Ask the children to make the mark for *many* in the red square in their books. Look at each book to see that the mark has been made correctly. Draw another square and show the mark [O] they would have made if the boy had had few toys.

3 Discuss the second picture with the children and have them make a mark in the square in their books.

4 Have the children work independently with the other pictures.

5 Let the children discuss their answers. Bring out that either *many* or *few* may be right if there is a good reason for the answer.

# 3



1 Tell the children what the red barn means [whether the toys shown are many or few if the boy lives in the country]. Make the mark ● on the chalkboard and remind the children that it means *many*. Make the mark O and remind them that it means *few*. Tell them to make a mark on the red barn to show what they decided.

2 Examine each book. Have the children make a mark on the red barn in each picture.

3 Direct attention to the red skyscraper. Tell the children what it means [whether the toys shown are many or few if the boy lives in the city]. Tell them to make a mark on the red skyscraper to show what they decided.

4 Have the children make a mark on the red skyscraper in each picture.

5 Let the children compare and discuss their answers.

## 4-7 SIMPLE PAIRING

### Objectives

The child becomes acquainted with the expressions *as many as*, *not as many as*, *more than*, *less than*, *too many*, *fewer*, *too few*, *enough*, *more than enough*, *not enough*, etc. Simple pairing of one group of objects with another group of objects (one-to-one correspondence) enables the child to form judgments as to their relative size. Pairing is a prerequisite for meaningful counting, and evaluations expressed by *as many as*, *more than*, etc., should be made without counting. Matching an object in one group to an object in another group and repeating until one group is used up is the most natural way to teach the idea of one-to-one correspondence.

### Preliminary Teaching

Before using Worksheets 4-7, the children must have some experience in matching one group of objects with another group of objects without counting. They should be able to express the results of this matching by using *as many as*, *more than*, *fewer than*, *enough*, *not enough*, *too few*, or *too many*, etc. Simple activities in which the furniture and other objects in the classroom are used are effective and easily planned and executed. Start by asking such questions as: "Are there as many chairs as there are children in the room? Are there fewer chairs than children? How do you know?"

Try to get the children to discover that if every child has a chair, and there are no empty chairs, there are as many chairs as children. If they need help, ask: "Does everyone have a chair? Are there any chairs left over? If some children do not have chairs, are there fewer chairs than children?" Continue by saying, "When we read, are there enough books for

everyone? Are there enough erasers for everyone in the room? If each child needs only one eraser, are there more than enough?" Show them that they can find out if there are as many objects in one group as there are in another by matching the two sets of objects one to one. Let them practice pairing boys and girls, children and books, etc. Be sure all the children understand what *as many as*, *enough*, etc., mean.

The activities centered around things in the classroom can be varied by having the children discuss objects at home or on the playground that they might think of in terms of *enough*, *not enough*, or *one for each*; for example, plates on the dinner table, swings on the playground, or cup-sakes at a party.

The introductory teaching for Worksheets 4-7 will probably take no more than one arithmetic period for a group that is average. With a less able group it may be necessary to spend several days on class activities and discussions before the children are ready to use the worksheets. An extremely able group may be able very quickly to make generalizations as to whether there are *more than enough* or *enough* and go on to Worksheet 4 within one arithmetic period. [When the children show that they understand what is meant by the various expressions and are able to make evaluations by pairing, they are ready to use Worksheets 4-7.]

## 4 Comments

On this page the children match, or pair, members of two groups of objects and evaluate the results as *too many* or *not enough*.

Markers, which are used with many pages throughout *Our Number Workshop 1*, are introduced for use with this page. Any small objects can be

used—buttons, plastic disks, shell macaroni, pebbles, or strips of cardboard bent so that they will stand up. Markers provide a simple and reliable way of keeping track of the objects from one group matched to objects in another group, without counting. They are important also because using them gives the children the actual physical experience of matching one thing with another. Each child will need six markers.

Introduce the page by asking five or six children to come to the front of the room. Have either more or fewer books than children on hand, and pass them out. Let the rest of the class decide whether there are too few or too many books. Draw a square on the board, and let one of the children tell which mark should be made in the square; then write it in the square. Change the number of books and the number of children, and repeat the procedure. If the children understand what they are doing, begin work with page 4 in *Workshop 1*. If they seem confused, or do not understand what the response marks mean, repeat the above procedure a few more times.

Work through at least the first picture with the children. Explain that they are to find out if there are too few or too many objects in each of the smaller pictures for each child in the big picture to have one. Show them how to put a marker on each child in the big picture and then move the markers one by one to the ice cream cones. They should write the response mark in the red square in the lower right hand corner of the small picture.

It may be necessary to work through several pictures with the slow learners, asking each time if they have moved all the markers and if any objects do not have markers on them. Let the pupils tell what the response should be in each case.

This worksheet can be checked by using a transparent overlay showing the correct responses. This overlay should be placed over the pupil's worksheet in such a way that the correct response symbol is next to the red square in which the pupil's response has been written.

## 5 Comments

On this page the child gets further experiences with the ideas of *too many* and *not enough*, and the idea of *just enough* is included. The third of the five response marks used in *Our Number Workshop 1* is introduced.

This worksheet continues the simple pairing, or making a one-to-one correspondence, started on the preceding worksheet. The new response mark (used to indicate *just enough*, *equal amounts*, and *the same quantity*) is the *equals sign* (=).

Introduce the page by reviewing the two response marks the children have been using. Ask several children, in turn, to go to the chalkboard and make the sign for *not enough* or *too many*. Be sure each child erases the sign he has made before he returns to his seat. Then let several children go to the board, one at a time, make either of the marks, then ask the class what it stands for. This can be varied slightly by letting some of the children tell the class which sign they are going to make before they make it.

Put the new sign on the board and explain that it means *just enough* or *the same number of things* and that it is called the *equals sign*. Demonstrate the use of the equals sign by using the following procedure. Draw two X's on the board and three circles under them and ask the class if there are too many or not enough X's for the circles. If necessary, draw a line from each X to a circle. When they

say there are not enough X's, ask them which mark they would use to show *not enough*. Make the mark for *not enough* under the circles. Now draw four X's and three circles. Ask if there are too many or not enough X's and which mark they would use to show their answer. Put the mark under the second set of circles. Put three X's on the board and three circles underneath, and ask the children if there are too few or too many. Get them to say that there are just as many X's as circles, or just enough X's to join one to each circle. Tell the children that the new mark, the equals sign, is used to show that there are just as many X's as circles, and make the equals sign under the third set of circles. Finally, have several of the children try making the equals sign on the board, and let the others practice making it on a piece of paper.

Leave the three sets of drawings on the board while the children do the work on Worksheet 5. They use markers for the exercises on this page, as they did on the preceding page.

The nine pictures showing children and toys are to be used at this time. The red strip at the right of the page will be used later with Worksheet 7.

The technique suggested in the notes for Worksheet 4 for working with a slow group may be used with this page.

Like Worksheet 4, this page can be checked by using a tissue overlay showing the correct response marks.

## 6 Comments

On this page the children match the objects in one group to the objects in another group and evaluate the results as *just enough*, *not enough*, or *too many*.

As with the preceding page, the children use markers. Each child will need six.

Introduce the page by letting the children discuss the pictures for a few minutes. Then guide the discussion so that the children discover that the things in the red strip in each picture belong with the things in the white strip. Ask them what they think they are to do. If necessary, review the three response marks. Talk about each of the first three pictures with them so that they get the idea that they are to decide if there are *enough*, *not enough*, or *too many* garages for cars, cradles for the baby dolls, or buggies for the little girl dolls. Explain that their answers will always be about the things in the white part of the picture where the red square is.

With a slow group it may be necessary to discuss every picture. Do not ask them to tell their answers. Ask questions like "Is there a hat for every clown? Are there too many hats for the clowns? Are there not enough hats?" Have the children make a response mark in each red square.

Worksheet 6 can be checked by using the same type of tissue overlay suggested for the preceding pages.

## 7 Comments

On this page skill in pairing is developed by having the children match groups by pattern.

The colored strip of pictures from Worksheet 5 is used with this page. This type of page occurs frequently throughout the book. While the objectives of the worksheets change from page to page, the technique for using the red key strip is always the same. Page 5 is placed over page 7 so that the outside edge of the red strip is against the solid red line on the right side of page 7 and held or folded so that it stays in position. The children then do the work with the five pictures in the white vertical row. The red strip is then moved to the rows at

the left and held or refolded so that the right edge of the red strip is, in turn, against the solid black line, the broken red line, and the broken black line, while the children do the work with each of the other vertical rows. If it is hard for the children to hold the page or fold the page and hold the strip in position while they are working, the strip may be cut from page 5 and laid flat on page 7. Also, it may be easier for the children to work across the page rather than from top to bottom. If they work across the page, they will do all the drum pictures first, then all the kite pictures, etc.

Introduce the page by asking the children what they have done up to this point in the book. Let them tell what they have learned about *many* and *few*, *more than*, *fewer than*, and *as many as*, and let three of the chil-

dren put the three response marks they have been using on the board. Let several children in the class identify the marks or tell the children at the board what marks to make. This review should take only a few minutes. Then show them how to use the red strip.

The exercises on page 7 give the children final practice with *more than*, *less than*, and *as many as*, and also give them their first experience in looking at groups. Much of the work in this book is based on group recognition. The simplest introduction to group recognition is to look at two small groups of like objects in each of which there is the same number of objects arranged in the same pattern.

An average or able group will have no trouble completing this page in one arithmetic period. After you have shown them how to use the key strip

and have helped them with one or two pictures, they should be able to work independently.

A slow group will need help with all the pictures in one row, and these children may need to use markers. Tell them to put the key strip in position next to the vertical row of pictures farthest to the right and to put a marker on each drum in the red strip. Then they are to move the markers one at a time to the drums in the white picture and decide whether there are *as many as*, *more*, or *fewer* drums in the white picture.

This page may be checked by using the same type of transparent overlay suggested for the preceding page.

## 4

1 Give each child six markers, and tell the children to put one marker on each child in the big picture.

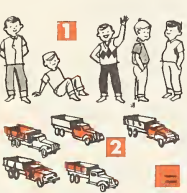
2 Direct the children to move the markers, one at a time, to the ice cream cones in the first small picture. They should place only one marker on a cone. When they have finished, ask if there are any markers left on the children. Ask if there are too many cones or not enough cones for each child to have one.

3 Remind the children that the mark ● means *too many* and the mark ○ means *not enough*. Ask them to put the mark they think is the correct one in the red square in the corner of the picture.

4 Tell the children to put all the markers back on the children and do the same things with each of the other pictures on the page.

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# 5

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1 Explain that the red strip at the right of the page will be used later. Introduce the equals sign. Then give each child 5 markers and tell the class to put a marker on each boy in the first picture.

2 Have the children move the markers one by one to the toy trucks. Ask whether there are *not enough*, *just enough*, or *too many* trucks for each boy to have one. Tell the children to put the mark [O, =, or ●] that shows their answer in the red square. Check to see that the children are responding correctly. Be sure their answers are in terms of trucks.

3 Explain that for each white picture on the page they are to decide whether there are *just enough*, *not enough*, or *too many* toys for each child in the picture to have one, and make the correct mark.

# 6

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1 Give each child six markers. Tell the children to put a marker on each car in the red part of the first picture.

2 Explain that the things in the red part of the picture need the things in the white part of the picture. Ask the children to move the markers one by one to the garages.

3 Ask if there are enough garages, not enough garages, or too many garages for each car to have one. Remind them that the mark ● means *too many*, the mark O means *too few or not enough*, and the mark = means *just enough*. Tell them to put the correct mark in the red square in the corner of the white picture.

4 Present one or two more pictures in the same way. Then ask the children to follow the same procedure for each of the remaining pictures on the page.

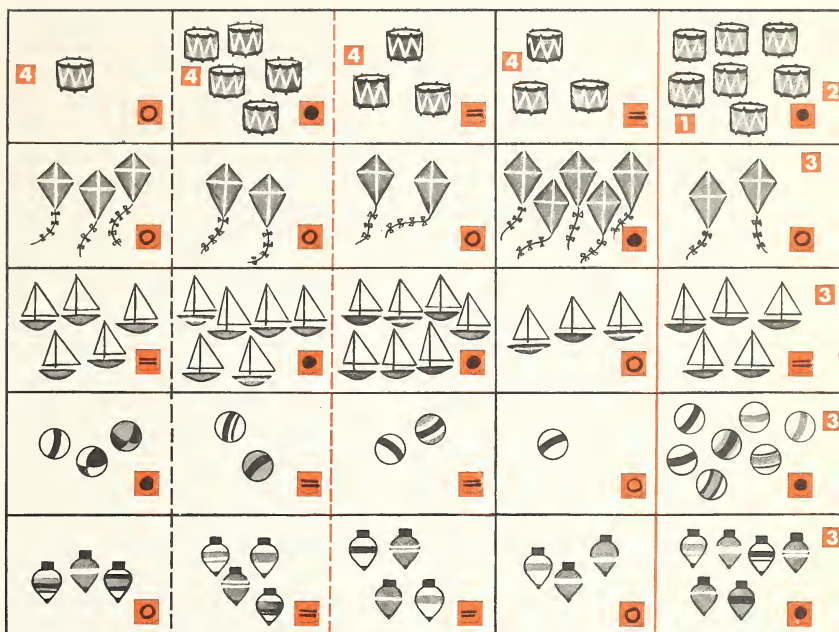
# 7

1 Show the children how to place the red strip from page 5 on page 7 so that its right edge is against the solid red line. Ask them to decide whether there are more drums in the white picture than in the red picture, or whether there are fewer or as many.

2 Have them put the mark [●, ○, or =] that shows their answer in the red square.

3 Tell the children to do the same for the other pictures in the white vertical row.

4 Show the children how to move the strip to the left, row by row, so that each time it is moved, a new set of white pictures is in position next to it. Tell them that they can work across the page (all the drum pictures first, then all the kite pictures, etc.), if they wish. Let them finish the page.



## 8-10 BIG, LITTLE, TALL, SHORT

### Objectives

Worksheets 8-10 provide experiences in reacting to ideas of size. The child decides whether an object is as *big*, as *tall*, as *long*, *bigger than*, *taller than*, *biggest*, *tallest*, etc., in relation to some standard of comparison.

### Preliminary Teaching

Two important ideas that the children must understand before attempting the exercises on Worksheets 8, 9, and 10 are that the concepts expressed by *big*, *little*, *long*, *short*, and *tall* are both comparative and relative—comparative, because in judging height or size, we measure the thing we are judging against something else. Sometimes this is done consciously, as when we use a measuring tape; sometimes unconsciously, as when we look at a

seven-year-old child and unconsciously measure him against all that our experience has taught us about sizes and heights of seven-year-olds. The concepts also are relative, because *big* or *little* often means not merely in comparison with other like objects, but also in relation to unlike objects, or to the environment. For example, a child who is large compared with his playmates is small compared with adults, and the largest adult is small compared with a tall building which, compared with a mountain, is very small. Activities that will clarify these ideas for the children and give them experiences in using them can be centered on the children themselves, the teacher, and the furniture and materials in the classroom. You might ask: "Which is

the biggest piece of furniture in the room? Which is the smallest? Is a table little or big compared to the room?" Encourage the children to originate their own questions and comparisons. If they wish to, let them discuss such things as pets, buildings, etc., but be sure always to guide the discussion so that the relative aspects of the children's judgments are emphasized. For example, encourage them to compare a kitten with a fully grown cat, then the cat with a horse, etc. Continue these activities until the children demonstrate that they can make reasonably accurate judgments about what is *big* and what is *little*.

[Worksheet 8 can be used at this point.]

Next, using the same type of discussion, the children are to evaluate *tall*, *short*, and *long*. Ask them: "Who is the tallest person in the room? Is

the tallest child big or little compared to a grown-up? Are there any children here who are almost the same height? Who is the shortest?" Have several of the children who differ greatly in height come to the front of the room. Line them up with the tallest child at one end and the shortest at the other, and discuss their heights. Let them return to their seats.

Then ask: "Which is longer, the desk or the bulletin board? Which is longer, the bulletin board or the chalkboard? Which of these things is longest?" Rods or sticks of various lengths, strips of paper cut in different lengths, or lengths of colored yarn can be used. The idea of *tall enough* can be developed by having the children try to reach marks on the chalkboard or bookshelves, or by discussion of such activities as picking apples or cherries or putting away the dishes at home.

[Worksheets 9 and 10 can be used at this point.]

Each section of the activities described above will probably take only part of a class period with a group that is average or better in ability. If the less able children seem to need more preliminary work, it would be wise to devote at least one class period to activities dealing with *big*, *little*, *tall*, *short*, and *long* before having them try Worksheet 10, which requires them to be able to distinguish among and use all these ideas on one page.

## 8 Comments

On this page the children are to find the object that is *largest*, the object that is *smallest*, and the objects that are the *same size*.

The children must understand that when they are deciding whether something is big or little, they do so by comparing it with something else—

sometimes a like object, sometimes an environment, sometimes an unlike object. For example, a chair might be judged large or small by comparing it with other chairs, the room in which it stands, or a footstool. In each case the decision might vary. The same chair might be either large or small compared with other chairs. It would almost certainly be small compared with the room in which it stood, and would very likely be large compared with a footstool. On this page and the two pages that follow, the children learn to make judgments about size and develop flexibility about those judgments.

The response marks used to mean *many* and *few* are used here to mean *big* or *biggest*, and *small* or *smallest*.

To introduce this page, have a collection of objects such as spools, boxes, and pencils in various sizes, and have the children take turns picking out the largest, the smallest, and those of the same size. If plasticine is available, give each child a piece. Tell them to make two balls each, a big one and a little one. Put the balls all together and let the children pick out the biggest, the littlest, and those of the same size. Let them discuss the comparative sizes of the plasticine balls. Put the marks for *many* and *few* on the board and explain that they mean *biggest* and *littlest* on this page. Let the children discuss how *many* and *biggest* have similar meanings, and how *few* and *littlest* are similar, and why it is sensible to use the same mark to show ideas that are alike.

An able or average group can be given brief directions for the whole page and permitted to work independently. The slow learners should be told to look at each picture on the page, find the biggest object, and draw a line from it to the square having the mark ● in it. They may need

help with several pictures before they are able to work by themselves. When they have found the *biggest* object in each picture, have them find the *smallest* object in each picture and draw a line from it to the square having the mark ○ in it. Finally, have them start with the first picture again and look for objects that are the *same size* and connect all such objects in each picture by a line. These children should be given as much help as they need with all parts of the exercise.

## 9 Comments

On this page the children select and indicate in each picture the object that is *tallest*, *longest*, or *shortest*, and those objects that are the *same height* or *length*.

Introduce the page by drawing on the board several trees with little squares under them. Have the children find the *tallest*, the *shortest*, and those trees that are the *same size*. Have three children put the response marks in the boxes under the trees. When they come to the trees that are the same size, remind them that the equals sign is the mark used to show that two or more things are alike in size or amount—that here it will be used to indicate the trees that are the same height. Allow the work on the board to remain while the children do the work in their books.

Have the children look at the first picture in the book, find the tallest tree, and put a response mark in the square under it. Have them find the shortest tree and put a mark under it. Then have them put the equals sign under any trees that are the same size. Explain that there may not be a response mark for every tree.

An able group can be given directions for the page and permitted to proceed independently with the work.

A slow group will need to be worked with in the way suggested in the notes for the preceding worksheet. If necessary, have such a group find the *tallest* or *longest* in all the pictures, then the *shortest*, and finally those that are the same size.

This page can be checked by using a tissue overlay showing the correct responses.

## 10 Comments

On this page the children compare the objects in each picture with a key object and select those that are *taller* or *bigger*, *shorter* or *smaller*, or *the same as*.

Instead of comparing the objects in the white part of each picture with each other, the children compare each of them with a key object in the red part of the picture. They are

not looking for the *tallest*, *biggest*, or *smallest* of a group, but are selecting from the group *all* those objects that are larger or taller than the key object, *all* that are smaller than the key object, and *all* that are the same size. Tell them to be sure that there is a mark in every red square on the page when they are finished.

Introduce the page by having several children line up at the front of the room. Ask one child to stand at the head of the line and a little apart from the others. Choose one or two children who are taller than this child, one or two shorter, and at least one who is about the same size. Ask the class to name the children who are taller, the children who are shorter, and the children who are about the same size as the first child. If you wish, you may then ask them to suggest other children in the class who

they think are taller, shorter, and about the same size as the first child. Let the children who have been suggested replace children in line. Let the class decide whether they really are taller, etc., than the first child.

An able or average group should be able to do the work on this page independently after brief directions. The slow learners will need help with several of the pictures before they are able to work alone.

This page can be checked by using a transparent overlay like those suggested for previous pages.

## 8

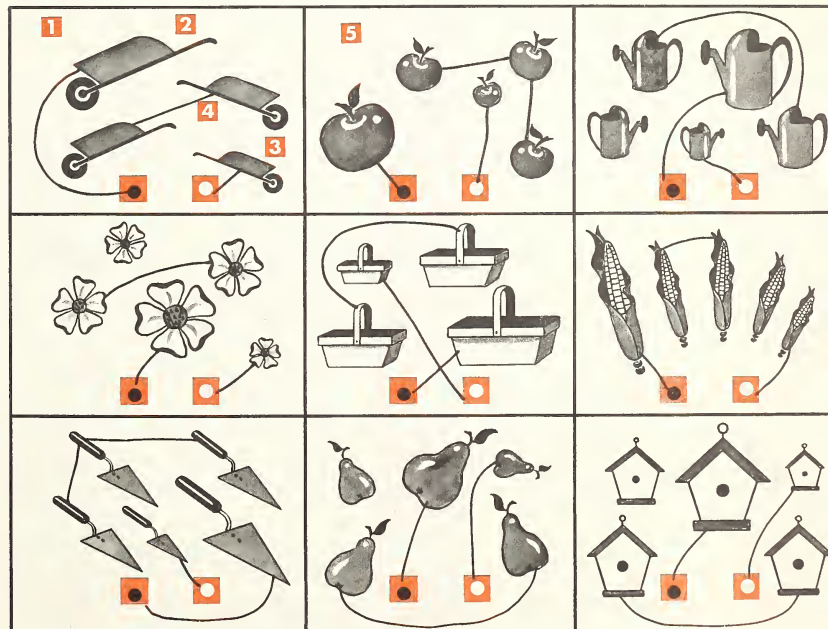
1 Get the children to notice that the objects in each picture on the page are exactly alike in every way except size.

2 Direct attention to the first picture. Ask the children to find the *biggest* wheelbarrow. Tell them to draw a line from it to the red square that has the mark ● in it. Remind them that this mark means *most*, *biggest*, etc.

3 Ask them to find the *smallest* wheelbarrow in the picture and draw a line from it to the red square with the mark ○ in it.

4 Ask them to decide if there are any wheelbarrows in the picture that are equal in size. If they think there are, they should draw a line connecting them.

5 Have the children follow the same procedure with the other pictures on the page.



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1 Ask the children to find the *tallest* tree and make the mark ● in the red square under it.

2 Ask them to find the *shortest* tree and make the mark ○ under it.

3 Tell them they are to decide if any of the trees are the same height and put the sign = in the red box under each of these trees.

4 Explain that if a tree is not the *tallest* or the *shortest* in the group, or if it is not the *same size* as some other tree in the picture, a mark should not be made in the square under it.

5 Have them follow the same procedure with the other pictures on the page.

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1 Point out that each picture is divided into a red part and a white part, and that the red part has in it an object of the same kind as the row of objects in the white part. Direct attention to the flower in the red part of the first picture.

2 Ask the children to find all the flowers in the white part of the picture that are *taller* than the one in the red part and to put the mark ● in the red square under each.

3 Ask the children to find all the flowers in the white part of the picture that are *smaller* than the flower in the red part and put the mark ○ under each.

4 Have the children find all the flowers in the white part of the picture that are the *same size* as the flower in the red part and put the equals sign under each.

5 Use Notes 2, 3, and 4.

## 11-14 TWO, THREE, AND FOUR

### Objectives

Learning to recognize instantly, without counting, model groups of 2, 3, and 4 objects is the child's first step toward understanding quantities of more than 4. His later skill in breaking up and identifying larger groups, and his even later mastery of the more complicated arithmetic processes, depend upon his understanding of these model groups. The activities suggested as an introduction to Worksheets 11-14 and the worksheets themselves help the child to develop this necessary basic understanding.

### Preliminary Teaching

Before doing the exercises on Worksheets 11-14, the children must be able to recognize without counting and to discriminate among the model groups of 2, 3, and 4, and they must have had the physical experience of actually forming groups, which is very helpful in the development of group recognition.

Start by asking each child in turn to name things of which he can see two or three in the classroom, outside the window, or on the way to school. Then have him name all the things he can that always come in twos or threes. If he needs help, ask such questions as: "How many shoes do you wear? How many gloves are there in a pair? Do you know what twins are? How many sleeves are there in a sweater? Does anyone have a bicycle? How many wheels does it have? Can anyone think of something that is like a bicycle but that has three wheels? How many wheels does a wheelbarrow have?"

Next, hold up sheets of paper or cards that show pictures of two objects and three objects, or hold up pencils, sticks, or other small objects

in twos and threes. Have the children take turns in responding orally to show that they can discriminate between groups of 2 and groups of 3.

When the children are able to distinguish between groups of 2 and 3, they are ready to form groups. Give each child 12 or 15 small objects, such as buttons or stones, and ask the children to arrange them first in groups of 2, then in groups of 3, and last in groups of both twos and threes. Tell them to plan the groups of twos and threes so that there are no objects left over. The arrangement of groups is an extremely important part of the child's experience with number and should never be omitted.

[Worksheets 11, 12, and 13 can be used at this point.]

The same procedures outlined above should be used to introduce groups of 4. Have the children point out groups of 4 objects that they can see in the classroom or from the window, and let them discuss things that always come in groups of 4. If they need help, ask such questions as: "How many wheels does a car have? How many legs does a table have?"

Be sure to give the children ample opportunity to make groups with markers such as they used for the twos and threes. Start by having them make groups of 4, then groups of 2, 3, and 4. At this point the children will presumably know the twos and threes, but if any of them are still having trouble with these groups, more work in recognition and formation of groups of 2, 3, and 4 should be given before going on to the next section of worksheets.

[Worksheet 14 can be used at this point.]

With an average or better than average group, it should be possible to include both the discussion of twos

and threes and some work in group formation in one arithmetic period. However, at least one more full arithmetic period should be devoted to group formation before using Worksheets 11, 12, and 13 and one full period to discussion and formation of groups of 4 before using Worksheet 14. With less able children it may be necessary to spend some part of each arithmetic period on making groups with markers before they go on to the exercises in the *Workshop*. If possible, the kind of markers should be varied from day to day, and each day the children should be given a different number of markers to work with.

## 11 Comments

On this page the children learn to identify groups of 2 and 3.

Most children will already be somewhat familiar with the quantities 2 and 3. Now they must learn to think of groups of 2 and groups of 3 and be able to recognize these groups instantly, without counting, no matter which of several possible arrangements is used.

The fourth of the five response marks used in *Our Number Workshop 1* is introduced on this page. Like the others, it is simple for the child to make and is related in form and meaning. The new mark is "X," and it means "this one," or acceptance.

Introduce this page by making an "X" on the board. Ask the children if they have ever heard the phrase "X marks the spot" and what they think it means. Discuss it with them until you get them to understand that an X is often used to mean "here" or "this one." Tell them that they are going to use X to mean those same things in this book. Next, draw two simple objects on the board and put an open and a filled-in square under them. Then draw a group of 3 other

objects near the group of 2 and put an open and a filled-in square under them. Explain that on this page they are going to put an X in one of two squares to tell whether the picture shows 2 or 3 objects. Remind them that the open circle means *few or less than* and the solid circle means *many or more than*. Tell them that they are to put an X in the open square if they want to say "two" and an X in the solid square if they want to say "three." Explain that they are to do it that way because 3 is more than 2. As you are talking, put an X in the open square under the group of 2 and an X in the filled-in square under the group of 3. Leave the pictures and squares on the board while the children work on Worksheet 11.

Make it clear to the children that there should be an X in only one square in each picture, and watch when they begin to work on their own to be sure they understand.

The keyed notes give directions that will be sufficient for an average or able group. A slow group will need help with several of the pictures, possibly with half the page or more.

This page may be checked by using a transparent overlay.

## 12 Comments

On this page the children form groups of 2 and 3.

The next step beyond recognizing groups of 2 and 3 is to make them. In this exercise the children make groups by drawing rings around the objects in the pictures.

Introduce this page by giving each child 12 markers. Jacks or square wooden beads would be very suitable, but any small objects will do. Ask the children to scatter the objects at random on their desks and arrange them in groups of 2. Tell them that they must put all the objects in groups.

Watch to see that they do this correctly. Next, have them scatter the objects again and arrange them in groups of 3, making sure that none are left over. Finally, ask them to scatter the objects once more, this time putting them in groups of 2 and 3 with none left over.

Now an average group may be given directions to encircle groups of 2 and 3 on the page in their books. If a slow group finds it difficult to plan the groups of objects, however, you might fasten over the page in each child's book a piece of transparent paper on which they can make the rings. Tell the children they are to make groups of the objects in the book, just as they did with the objects on their desks, but that since the objects in the book cannot be moved, they are going to do it by drawing rings around them. Explain that the objects they put in each group should be close together, that an object can be in only one group, and there must be no objects left over. Suggest that they plan their groups before they draw any rings. Watch their work, and show them any mistakes. The balls are to be put in groups of 2, the jacks in groups of 3, and the blocks and tops in groups of 2 and 3.

After the children have practiced making groups on the transparent paper, they are ready to work on the page itself. Encourage them to see in how many ways they can make the groups. When they have finished the page, let them compare and discuss the work.

This exercise must be checked by looking at each child's paper. Since there are many different arrangements of groups of 2 and 3 that can be made, any arrangements that the children choose to make should be acceptable as long as the groups have the correct number of objects in them and do not overlap.

## 13 Comments

On this page the children find groups of 2 and groups of 3 that have some common characteristic.

It is important for the children to realize that any collection of persons or things that have a similar feature may be considered a group on the basis of that feature. Their ability to perceive relationships will be limited if, in their early training, grouping has been limited to groups identified by arrangement only.

The fifth and last of the response marks used in *Our Number Workshop 1* is introduced on this page. It is , a scribble mark to be made in the response square, and it means *no, not this one, none, or, farther on in exercises where the children are asked to estimate something, cannot tell*. It is introduced here because in this exercise the child not only must find groups of 2 and 3, but must also be able to show that in some cases there are no groups of 2 or 3.

Introduce this mark by asking the children if they have ever made a mistake in drawing or writing something and then have scribbled over it. Put the mark  on the board and, by discussion and letting them practice making the mark on paper, get them to see that it is an easy and logical mark to use if you want to reject or dismiss something. Explain that they are going to use this mark to mean *no, none of these, there are none, I cannot tell, or I do not know*.

Continue the introduction of the page by drawing on the board 3 groups of simple objects such as balls, trees, or apples. For example, you might draw 2 balls, 3 trees, and either one or 4 apples. Under each group put two squares, one in outline and one filled in lightly. Remind the children that they have used X to mean *this one or here*. Tell them that

here they are going to decide whether the groups show 2 or whether they show 3, or neither 2 nor 3. Ask one child to find the picture on the board that shows a group of 2. When he points to it, put an X in the open square and explain that the mark goes there because 2 is less than 3. Ask another child to find a group of 3. When he does, ask where you should put the X. He should say "In the solid square" because 3 is more than 2. Put an X (in colored chalk) in the solid square under the group of 3. Then point to the last group and ask: "Does this show a group of 2 or a group of 3?" When the children say "No," make a scribble mark in each of the squares and explain that the scribble mark in the open square means *not* a group of 2 and the scribble mark in the solid square means *not* a group of 3.

Next ask 2 or 3 children who are wearing something alike (glasses, white shirts, jeans, etc.) to come to the front of the room. Tell the class that there is something alike about the children in front of the room, and ask them what it is. If they say "They are all boys" or "They are all in this class" or "They are nearly the same size," agree that these are ways in which they are alike, but ask questions and make statements that will lead them to mention whatever it is they are wearing in common. When they select the right thing, say: "There are three children wearing white shirts." Do the same thing with a second group of children who are all wearing something else alike.

Next have two or three other children come to the front of the room. Tell them quietly, so that the rest of the class does not hear, to do something—raise their right hands, stand on one foot, etc. Ask the class what is alike about this group, and lead the discussion until someone says that

they are all doing the same thing. Talk for a few minutes about how it is possible to think of people who are wearing something alike or doing something alike as a group.

Ask the children to look at page 13 and see if they can find children in the picture who are wearing something that is the same or doing something that is the same. Direct attention to the bottom of the page, and point out that the child in each small picture is wearing, holding, or doing something that one or more of the children in the big picture are wearing, holding, or doing. Talk a little about the important thing in each small picture. (The black jumper on the little girl in the second picture, the big hairbow on the little girl in the picture below, the doll the girl in one picture is holding, the fact that children in other pictures are riding a scooter, drinking from a fountain, doing a handstand, etc.). Get the children to observe that there are two response squares for each picture, one in outline and one filled in, just like those under the pictures on the board. The specific directions given for this page in the keyed notes should be used at this point.

An average group should be able to do the work on this page independently after you work through one or two small pictures with them. A slow group will need to have help with several pictures at least, possibly with all. Be sure all the children understand that there are three ways to give the answer: an X in the open square to show that there are 2 in the group, an X in the filled-in square to show that there are 3 in the group, and a scribble mark (≡) in each square to show that there are no groups of 2 or 3.

This page may be checked by the children as they discuss and compare their answers. Any answer that the

child can justify should be accepted. For example, either 3 or "No" could be correct for the small picture of the boy standing on his head; he is wearing a plaid shirt, and there are two other boys wearing plaid shirts in the big picture, but only one boy is standing on his head. Let the children use their own judgment, and point out in the discussion that there may be more than one right answer for several of the small pictures.

## 14 Comments

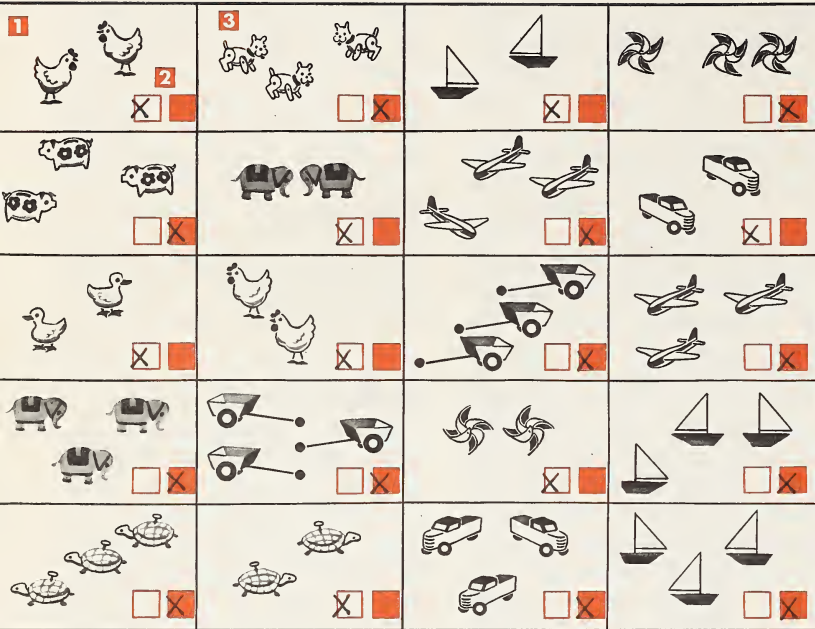
On this page the children form groups of 2, 3, and 4. They make groups by drawing rings around 2, 3, or 4 objects, as they did on page 12.

To introduce this page, show the children several groups of 4 (4 books, blocks, or paper cups on a table, 4 pencils in your hand, etc.). Ask them to hold up 4 fingers. By putting 4 objects on a table, one at a time, show the children that 4 is more than 2 or 3.

Give the children 12 markers each, and ask them to scatter the markers on their desks. Ask them first to put the markers into groups of 2, then to scatter them again and put them into groups of 3, then into groups of 4, and finally into groups of 2, 3, and 4.

This page is like page 12 except that it is extended to include groups of 4. The instructions given in the comments for page 12 for adapting the exercise for a slow group and for discussing and checking the page apply to this page also.

# 11

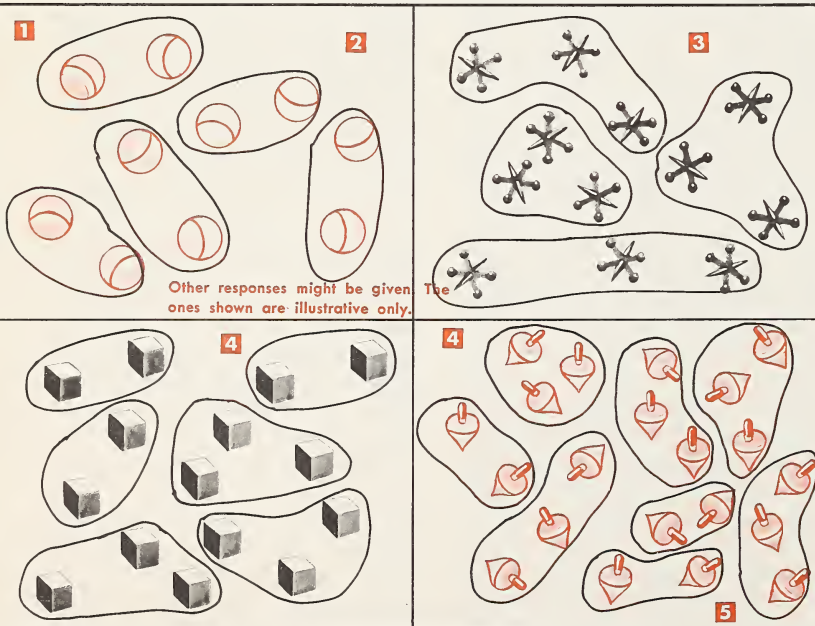


1 Introduce the new response mark, X.

2 Direct attention to the two squares in the first picture on the page. Remind the children that the open square stands for "two" and the solid square stands for "three" because three is more than two. Tell the children that they are to decide whether there are 2 chickens or 3 chickens in the picture. Tell them to put an X in the white square if there are 2 chickens and to put an X in the red square if there are 3 chickens.

3 Have the children do the work for the rest of the page independently. Ask them to decide, for each picture, whether there are 2 objects or 3 objects and write an X in one of the squares.

# 12



1 Ask the children to have two crayons of different colors on hand.

2 Direct attention to the balls. Tell the children that they are to draw rings around groups of 2 balls each. Remind them that the balls in each group should be close together, that each ball may be used in only one group, and that there should be no balls left over. Suggest that they plan the groups before they draw the rings.

3 Ask the children to draw rings around groups of 3 jacks.

4 The blocks and tops are to be put in groups of 2 and 3. Ask the children to encircle the groups of 2 in one color and the groups of 3 in the other color.

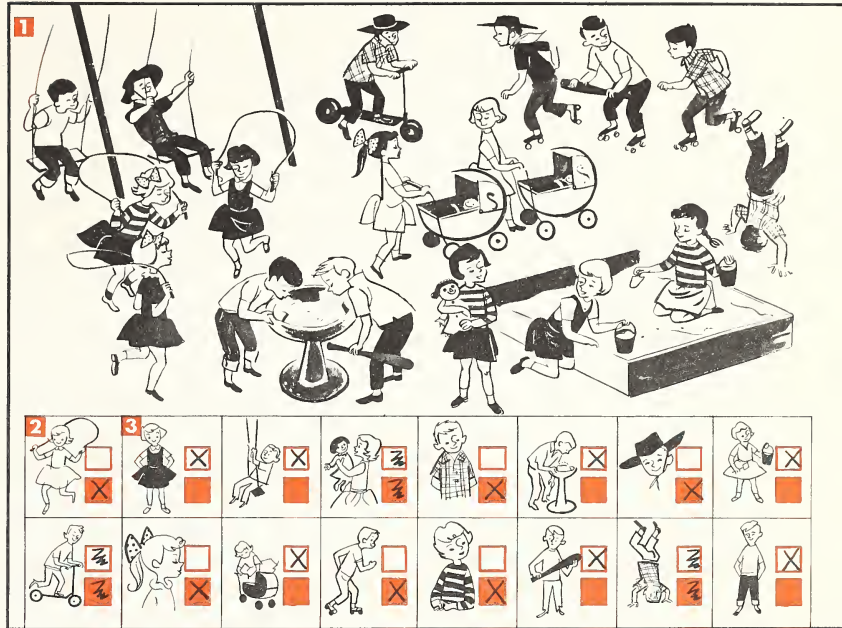
5 Let the children compare their work and discuss the many different ways of making groups.

# 13

1 Introduce the new response mark (see "Comments"), and give each child 4 or 5 markers. Tell the class they are to find in the big picture groups of 2 children or 3 children that are alike because of something they are doing or wearing.

2 Ask the children what the girl in the first small picture is doing, and tell them to put a marker on each child in the big picture who is jumping rope. If there are 2 girls jumping rope, they are to put an X in the open square in the small picture. If there are 3 girls jumping rope, they are to put an X in the red square. If there are neither 2 nor 3 girls jumping rope, they are to make a scribble mark in each square.

3 Tell the children to follow the same procedure for each small picture. Let them correct their own work if you find they can do so with confidence.

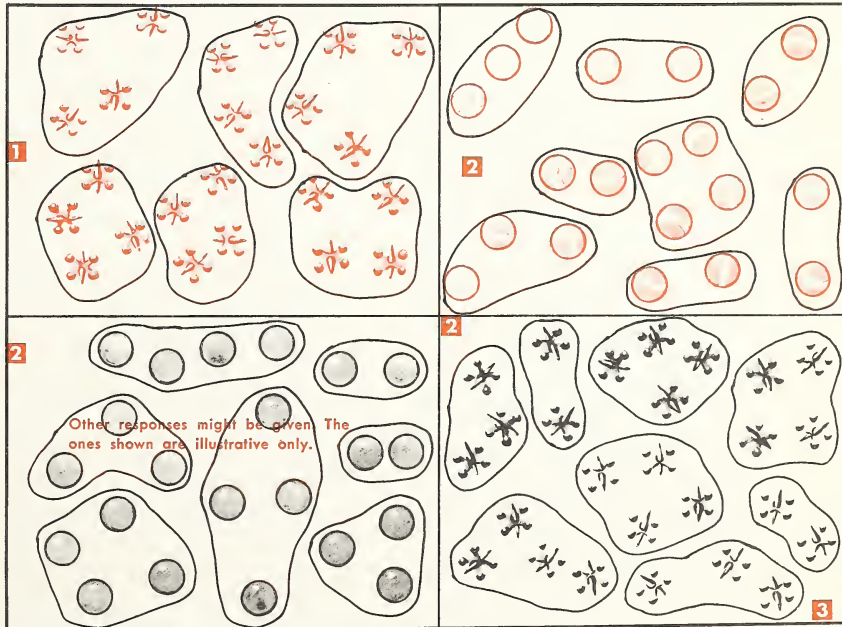


# 14

1 Direct attention to the red jacks, and tell the children they are going to make rings around groups of 4 jacks. Remind them that objects for a group should be close together, that each jack must be used in only one group, and that all the jacks must be used. Encourage them to plan the groups carefully and to encircle them with their fingers before they draw rings around them.

2 For the red balls, black balls, and black jacks, have the children make groups of 2, 3, and 4. All the objects must be used, none may be used in more than one group, and the objects in each group must be close together. Tell the children to use a different color of crayon for each size of group.

3 Let the children compare their work and discuss the different ways of making groups.



## 15-19 POSITIONAL MEANING OF 1 TO 5

### Objectives

Numbers are used to indicate not only quantity, but also position. The positional meanings of numbers express stable relationships in an orderly sequence. The starting point may be determined by use, necessity, or convenience and is therefore variable. Whether we count a series of five objects from left to right, right to left, top to bottom, or bottom to top, 1 is always first, 5 last; 3 is always in the middle and separated from 1 by 2 and from 5 by 4. If the child is to have a full understanding of the positional meanings of numbers, he must learn these relationships and must understand that they do not change even if the direction of the sequence does. Worksheets 15-18 provide practice on the positional use of numbers, with particular emphasis on the relationships of the numbers within a sequence, and on the recognition of the number symbols from 1 to 5.

On Worksheet 19, groups of 2, 3, and 4 and relative size of objects are reviewed.

### Preliminary Teaching

Before the work on the exercises on Worksheets 15-19 is begun, the children should learn to count off a series of objects from 1 to 5, starting from the left and from the right. They must also become familiar with the positional relationships of the numbers.

Start by placing 5 objects, such as books, one by one in a row in front of the class. As you put them down, say "One, two, three, four, five." Or draw 5 circles, stars, or short vertical lines on the chalkboard one by one, saying "One, two," etc. as you draw. Go through either or both of these procedures several times, alternating between left and right as the starting point.

Ask 5 children to line up as if they were going to walk in single file, and point to each, starting with the first, as you say "one, two, three, four, five." Then ask the children to turn around so that they are facing the opposite direction. Ask a member of the class to count them off, starting with the child who now heads the line. Ask the class what number the first child was before and what number the last child was before.

Do not expect the children to know the directions "right" and "left," but always say "Start at this end," pointing to it, and be sure not to use the ordinal number words at this point. Refer to the objects or children as "number one, number two," or "one, two, three," etc. Direct attention to the 5 books again and say to the children: "Mary, find the middle book. What number is it? What is the number of the last book? What is the number of the book between book number 1 and book number 3?"

Continue by saying: "Now let's start at the other end. Tom, find the middle book. What number is it? Is it the same book that was in the middle when we started at the other end? Is it the same number? Point to book number 5. What is the number of the book between book number 5 and book number 3? Point to book number 2. What are the numbers of the books on each side of it? When we counted off from the other end, what number was book number 2? What number was book number 4? What number was book number 3? Which book always has the same number, no matter which end we start from?"

Have five children stand before the class. Let those children who are not standing up take turns asking each other riddles, such as: "I see a girl in a blue skirt. What number is she? I

see a boy with two children on each side of him. What number is he?" Place some groups of 5 objects around the room for the children to arrange in order by using number words. Five books, boxes, or blocks on a table, 5 chairs in front of the room, 5 pieces of paper of different colors, or 5 pictures of toys or pets on the bulletin board all work very well for this activity. Arrange some of the objects vertically, and have the children count off from top to bottom and from bottom to top. Emphasize the fact that the order of the numbers is always the same no matter where the starting point is.

[Worksheet 15 can be used at this point.]

Next, introduce the number symbols from 1 to 5. First, write them on the board, saying the names of the numbers as you write. Go over the names several more times, starting at the right, left, top, and bottom, in turn. Then let the children take turns giving the names of the numbers as you point to the symbols. Then give each child 5 cards or markers on which the number symbols have been written. Have the children arrange the cards in order several times, using different starting points.

Have the children scatter markers (with numerals 1 to 5 on them) in random order on their desks, and give such directions as "Find marker number 3. Put it in front of you. Now find the marker that would be last if we started at this side. Put it next to marker 3, but leave enough room for as many markers as you think belong between them. Now find the marker that should be first. Put it on the other side of marker number 3, but leave enough room for as many markers as you think belong between them. Now find marker number 2. Put it where it should be. What is the number of the marker that is left? Put

it where it should be. Move marker number 3 toward you. How many markers were there on each side of it? Move markers number 1 and 5 toward you. Now exchange marker 1 and marker 5. Is marker 3 still in the correct position? Move markers 2 and 4 toward you. Are they in the correct position now? What will you have to do to put them in the correct position?" This activity is an excellent one both for teaching recognition of the number symbols and for developing the positional relationships.

[Worksheets 16, 17, and 18 can be used at this point.]

One arithmetic period should be sufficient time for an average or able group of children to spend on the class activities that precede the use of Worksheet 15. The activities preceding the use of Worksheets 16, 17, and 18 will take an average group of children one arithmetic period and should be reviewed at the beginning of the following period, before Worksheet 16 is used. A less able group will need to devote several days to supervised class activities before attempting to use the worksheets. In all cases the children should be considered ready to use the worksheets when they demonstrate by their performance in the class activities that they understand the positional relationships of the numbers 1 to 5. The less able groups may not achieve the same degree of skill and confidence that the able groups acquire, and their use of the worksheets will need much closer supervision. With such a group, some directive attention to the recognition of the number symbols should be given with all worksheets on which the number symbols appear as long as the children need it. [On Worksheet 19, groups of 2, 3, and 4 and the idea of relative size are reviewed. This page may be used before the next unit is started.]

## 15 Comments

On this page the positional meanings of the numbers 1 to 5 are introduced.

Although flexibility in assigning numerical position from any starting point is important, the children must first know how to count off in order. On this page they concentrate on positions 2, 3, and 4, always starting from the left. Position 3 should be established in their minds as "middle" in a group of 5.

Introduce the page by drawing 5 simple objects, such as apples, on the board. Ask a child to find apple number 2 and put a line under it. Ask another child to go to the board, find apple number 4, and put a line above it. Ask a third child to go to the board, find apple number 3, and draw a circle around it. Erase all the marks and all but one of the objects. Ask the children to look at the first picture of ponies on page 15. Tell them to find pony number 2, and if it is red to put a line under it. Draw a line under the object on the board. Tell them to look at each picture on the page and put a line under pony number 2 if it is red. When they finish, direct attention to the first picture again, tell them to find pony number 4, and to put a line above it if it is red. Erase the line under the object on the board and put a line above it. When they finish, follow the same procedure by telling them to find pony number 3 and to draw a circle around it if it is red. Circle the object on the board as a reminder.

Directions for this page can be adapted to the abilities of the class. Most groups will need to go over the page three times, with a new set of directions each time. An able group may not need to have the response marks put on the board as a reminder. Slow learners may need supervision with some of the pictures each time

they are given a new set of directions. This page can be checked by using a tissue overlay showing the correct responses.

## 16 Comments

On this page the development of the use of numbers 1 to 5 to show positions is continued, and the symbols for numbers 1 to 5 are introduced.

For the first time in this book, the children are required to recognize the number symbols 1 to 5. Probably many of them already know these numerals by sight, although they may not relate them to the correct quantities.

After the children have learned the numbers in sequence, they must learn to be flexible in their application of the sequence. On this page they put the numerals in order, starting from the right as well as from the left. The exercise is designed to develop flexibility in recognizing numerical position, no matter where the starting point is.

Introduce the page by writing the number symbols on the board, saying the number names as you write the symbols. Do this several times. Then let the children take turns saying the names of the numbers as you point to the symbols. Follow this procedure starting at the top, the bottom, the right, and the left several times more. Next, give each child a set of markers with the numerals 1 to 5 on them. Have the children arrange the markers on their desks in order from left to right, right to left, top to bottom, and bottom to top. Finally, have them arrange the markers in order from left to right and right to left as they do the exercises in the book.

There is no basic difference in presenting this work to an average, an advanced, or a slow group. The adjustment to the ability of each must be

made in the length of time spent on the preliminary exercises and on the page. The work will be successfully completed when the children know the number symbols, and when they can put them in order starting from any direction.

This page must be checked by looking at each child's book, or by letting the children discuss and correct their own work.

## 17 Comments

On this page the positional meanings of the numbers 1 to 5 are developed. Additional experiences in recognizing number symbols 1 to 5 are provided.

Introduce this page by lining up a series of 5 similar objects, 4 of which are of the same color and one of which is of a different color. Real balloons would be suitable, and the children would enjoy them, but, if they are not available, books, paper cups, or even objects drawn on the board will do. Let the children begin counting off from the left, then have them count off starting from the right. Ask what number the colored object is starting from the left; then ask what number it is starting from the right. Change the position of the colored object and repeat the above procedure. Get the children to realize that the same object is always either "2" or "4," depending on the direction in which the series is counted off, that the same object is either the beginning or the end of the series, again depending on the direction in which it is counted off, and that the middle object, or number 3, is the only one that does not change its number if the direction of counting off is reversed.

For a slow group, follow the detailed directions given for the page in the keyed notes. Be sure to discuss the material on the page with the chil-

dren when they have finished the work.

A bright or average group of children can be told to count off from the left to the blue object in each picture, then to encircle the numeral at the left of the picture that tells what its position is, then to count off to the same object from the right and encircle the appropriate numeral in the column at the right of the picture.

A tissue overlay showing the correct answers for each picture can be used to check this page.

## 18 Comments

On this page the children learn to locate a position by using two numbers.

The children have learned to locate one of five objects in a series, counting off from the left and from the right. They know that the positional relationships in a series of five are the same when the series is counted off from top to bottom or bottom to top. On this page the children learn to locate a position within an area that is marked off both horizontally and vertically, like a checkerboard, by using two numbers.

On the left side of the page is a column of numerals and objects printed in blue. This is the key the children follow in making their responses. The remainder of the page is divided into rows of boxes. The rows run across the page horizontally and are counted off from top to bottom. The top row is Row 1, and the bottom row is Row 5. The boxes are counted off from left to right. The first box at the left of the page in each row is Box 1, and the last box is Box 5. The large gray objects on the page are to help the children locate the rows and boxes. The doll buggy is in Row 1, Box 1; the doll is in Row 2, Box 3; the book is in Row 3, Box 4, etc.

Introduce the page by drawing the five rows of 5 boxes each on the board. If possible, put the same simple drawings of objects in the same boxes. Ask some of the children to go to the board and locate various rows and boxes while the others in the group find the same rows and boxes in their books. The children should practice locating these objects until it is clear that they understand how to count off the rows and boxes.

The children are to draw the objects pictured in the key column in the box and row indicated by the two numerals preceding each small object. The first numeral gives the row; the numeral in the square gives the box. For example, the numerals and drawing on the top line mean that the children are to draw a kite in Row 3, Box 5. This is the box to the right of the picture of the book. The next line tells them to draw a ball in Row 5, Box 4. This is the box to the left of the gray car. Be sure the children understand that the first numeral tells them which row, and the numeral in the square tells them which box in the row.

An average or very able group should have no trouble completing this exercise within an arithmetic period. Less able children may not be able to do so, and they may either complete the work on the page in several consecutive arithmetic periods or return to it later in the year.

In evaluating the work, no emphasis whatever should be put on the quality of the drawing. Do not expect the pictures to be neat or exact. The objects in the key are simple enough to be copied by first-grade children, but some of them may not be able to draw very well. If the object is sufficiently recognizable so that you can be certain that it is in the correct box, it is acceptable. The children should concern themselves only with the locations of the boxes.

This page should be checked by letting the children compare and discuss their work.

# 19 Comments

On this page the children review groups of 2, 3, and 4 and relative size of objects.

This page will show up any weakness in the children's understanding of groups of 2, 3, 4, and of the idea of relative size. Any such weakness should be remedied before continuing. It is particularly important that the children know the 2, 3, and 4 groups, since all future work in grouping is based on them. If all the children seem to need further practice in recognizing these groups, spend a period or two working with markers and sight cards before going on to the next page in the book. If only a

few children in the group need help, work with them individually until they are able to proceed.

Introduce the page by reproducing the first picture on the board. Ask one of the children how many horns there are in the picture, and encircle the 4 above the horns. Ask another child which is the largest or tallest horn in the picture, and let him tell you, if he can, which response mark to put under it [●]. Let another child tell which is the smallest horn in the picture and which response mark to use, and let a third child find all horns of equal size. Be sure they remember the equals mark, and know that it should be used here. Leave this picture on the board while the children are working.

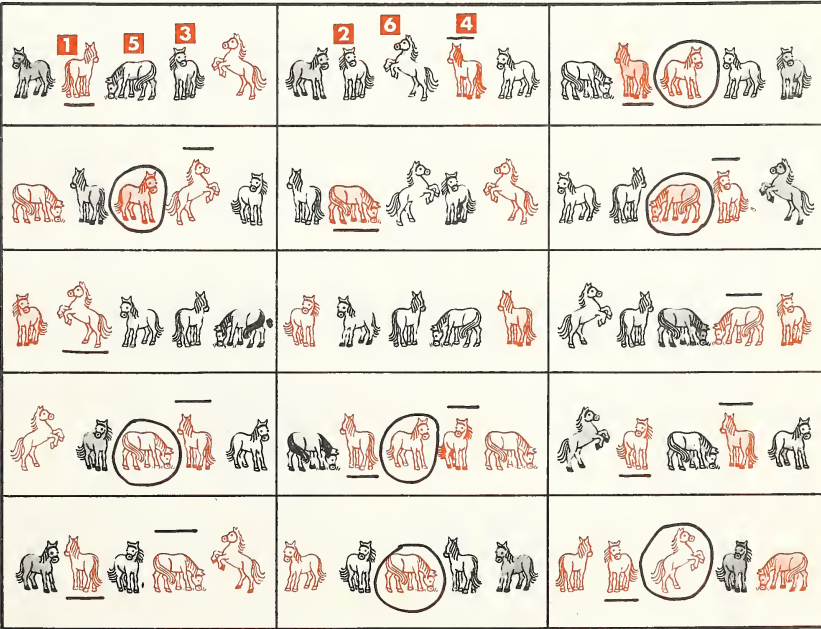
Average or rather slow groups should do this exercise in several parts. For a slow group, have the children look at each picture, decide

how many objects there are, and encircle the correct blue numeral. Then, have them find the largest and smallest object in each picture. Then they should look at each picture again and find the objects of equal size. For an average group, after the children encircle the blue numerals, ask them to go over the page and indicate the largest, smallest, and equal objects in each picture. A very able group can be given directions for all parts of the exercise at one time.

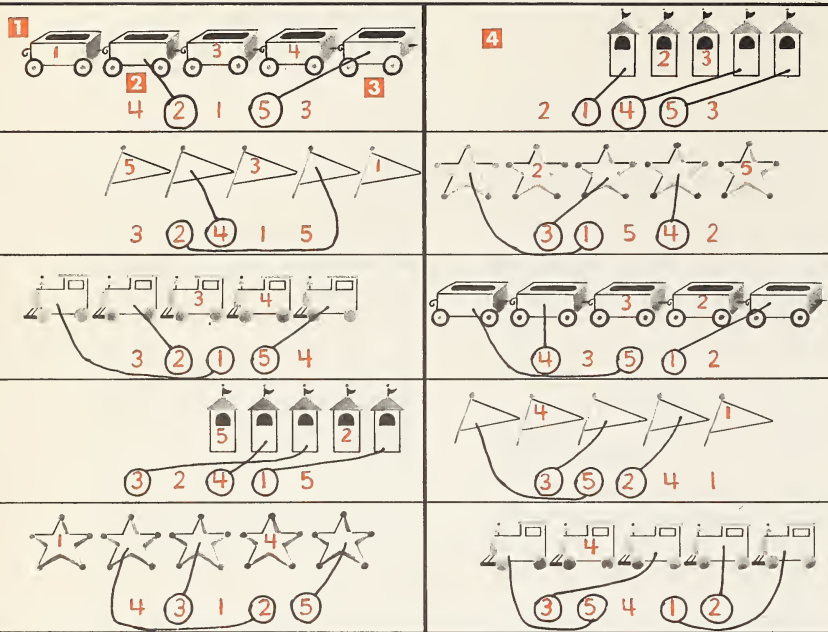
This page may be checked by using a tissue overlay showing the correct responses.

# 15

- 1 Direct attention to the first picture. Tell the children to find pony number 2, beginning at the left. Be sure to point to the left side of the picture. Tell them that if pony number 2 is red, they are to draw a line under it.
- 2 Have the children do the same thing for every picture on the page.
- 3 Ask the children to start again with the first picture. Tell them that this time they are to find pony number 4. If pony number 4 is red, they are to draw a line above it.
- 4 Have the children do the same thing for each picture.
- 5 Ask the children to return once more to the first picture. This time they are to locate pony number 3, and if it is red, draw a circle around it.
- 6 Have the children do the same thing for each picture.



# 16



- 1 Introduce the number symbols 1 to 5 by using the techniques suggested in "Comments."
- 2 Point out that some of the cars in the first picture have numerals on them. Direct attention to the row of numerals under the cars, and tell the children that some of these numerals belong on the cars that have none. Explain that the cars must be numbered in order, and ask the children to decide in which direction the cars are to be numbered. Tell them to decide which numeral should go on the car between Car 1 and Car 3, and draw a line from that numeral to the car.
- 3 Ask the children to find a numeral for this car and to draw a line from that numeral to the car.
- 4 Tell the children to select numerals for the unnumbered objects in each picture.

# 17



- 1 Direct attention to the first picture. Ask the children to decide what number the blue balloon is, starting from the left [point to the left], then to find the proper numeral among the black numerals at the left of the picture and draw a ring around it.
- 2 Tell the children to look at each picture, decide what number the blue object is, starting from the left, and draw a ring around the proper black numeral at the left of the picture.
- 3 Direct attention to the first picture again. This time ask the children to decide what number the blue balloon is, starting from the right, and draw a ring around the proper blue numeral at the right of the picture.
- 4 Have the children work in the same way with each picture.
- 5 When the children have finished the work, discuss each picture with them.

# 18

1 Use the large pictures to help the children locate the rows and boxes. The rows go across the page and are counted off from top to bottom. They are divided into boxes that are counted off from left to right. The buggy is in Row 1, Box 1. The book is in Row 3, Box 4.

2 Direct attention to the top line in the column of numerals and objects shown in blue at the left of the page. Tell the children that they are to draw a kite in Row 3, Box 5. Make sure they understand what they are to do and that they draw the kite in the correct box.

3 Tell them to draw each of the other blue objects in its correct box.

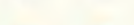
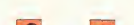
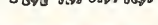
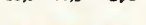
|   |   |   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                     |                                                                                     |
|---|---|---|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 2 | 3 | 5 |  |  |                                                                                   |                                                                                   |  |  |
| 3 | 5 | 4 |  |  |  |  |                                                                                     |  |
| 2 | 1 |   |  |                                                                                   |                                                                                   |                                                                                   |                                                                                     |                                                                                     |
| 1 | 5 |   |  |                                                                                   |                                                                                   |                                                                                   |                                                                                     |                                                                                     |
| 4 | 3 |   |  |                                                                                   |                                                                                   |                                                                                   |                                                                                     |                                                                                     |
| 5 | 3 |   |  |                                                                                   |                                                                                   |                                                                                   |                                                                                     |                                                                                     |
| 1 | 4 |   |  |                                                                                   |  |  |   |  |
| 3 | 3 |   |  |                                                                                   |                                                                                   |                                                                                   |                                                                                     |                                                                                     |
| 4 | 4 |   |  |                                                                                   |                                                                                   |                                                                                   |                                                                                     |                                                                                     |
| 2 | 2 |   |  |  |  |  |  |                                                                                     |
| 5 | 2 |   |  |                                                                                   |                                                                                   |                                                                                   |                                                                                     |                                                                                     |
| 2 | 5 |   |  |  |  |  |  |  |
| 3 | 2 |   |  |                                                                                   |                                                                                   |                                                                                   |                                                                                     |                                                                                     |
| 4 | 1 |   |  |                                                                                   |                                                                                   |                                                                                   |                                                                                     |                                                                                     |

# 19

1 Ask the children to decide how many horns there are in the first picture, find among the blue numerals above the horns the numeral that tells how many horns there are, and draw a ring around it. Explain that for each picture, they should draw a ring around a blue numeral.

2 Have the children look at the first picture again. Tell them to decide which horn is the tallest and put the mark ● in the blue response square under it. Next, ask them to decide which horn is the smallest and put the mark ○ in the square under it. Finally, ask them to find all the horns that are the same size and put the mark = in the square under each.

3 Use Note 2 for each picture. Warn the children that some pictures may not have a largest object, a smallest object, or two or more objects of the same size.

|                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| <p>1 2 3 4</p> <p>1 </p> <p>2 </p> <p>3 </p> <p>4 </p> | <p>1 2 3 4</p> <p>3 </p> <p></p> <p></p> | <p>1 2 3 4</p> <p></p> <p></p> <p></p>  | <p>1 2 3 4</p> <p></p> <p></p> <p></p> <p></p> |   |
| <p>1 2 3 4</p> <p></p> <p></p> <p></p>                                                                                                   | <p>1 2 3 4</p> <p></p> <p></p> <p></p>  | <p>1 2 3 4</p> <p></p> <p></p> <p></p> | <p>1 2 3 4</p> <p></p> <p></p> <p></p>                                                                                            |  |
| <p>1 2 3 4</p> <p></p> <p></p>                                                                                                                                                                                              | <p>1 2 3 4</p> <p></p> <p></p> <p></p>  | <p>1 2 3 4</p> <p></p> <p></p>                                                                                            | <p>1 2 3 4</p> <p></p> <p></p>                                                                                                                                                                                        |  |
| <p></p> <p></p>                                                                                                                                                                                                             | <p></p> <p></p> <p></p>                 | <p></p> <p></p>                                                                                                           | <p></p> <p></p> <p></p>                                                                                                           |  |
| <p></p> <p></p>                                                                                                                                                                                                             | <p></p> <p></p> <p></p>                 | <p></p> <p></p>                                                                                                           | <p></p> <p></p> <p></p>                                                                                                           |  |

## 20-26 SUBGROUPS OF 6, 8, AND 10

### Objectives

After the child has learned to recognize the model groups 2, 3, and 4, the next step is to learn to use those groups as subgroups of larger groups. The even numbered groups 6, 8, and 10 can each be formed by combining groups of 2 or groups of 4 (2,2) and 2. Each of these groups can also be formed by combining two equal subgroups, and they can be separated into two equal subgroups. Finally, each even numbered group can be separated into groups of 2. The child should learn to see 6, 8, and 10 in two ways: first, he should learn to visualize these numbers as an orderly progression of 2's, each number formed by so many 2's, and the following even number formed by including another 2—6 as 2,2,2; 8 as 2,2,2,2; 10 as 2,2,2,2,2; second, he should learn to visualize each of these numbers as also being formed of two equal groups. The ability to see and manipulate these subgroups helps to give the child a thorough understanding of the numbers 6, 8, and 10.

### Preliminary Teaching

Before using Worksheets 20-26, the children must be able to recognize groups of 6, 8, and 10, to form them by combining groups of 2 and by combining two equal groups, and to distribute them by 2's and by equal groups. They should know that 6 is formed by joining a group of 2 to two 2's, or 4, that when a group of 2 is joined to 6, 8 is formed, and that when a group of 2 is joined to 8, 10 is formed. They should also be able to see that the groups of 2 that form each of these numbers may be separated into two groups, that these groups are equal, and that when combined again they, too, form the original group. It is important to the

children's later understanding of the more complicated arithmetic processes that they learn to see the similar structure of the even numbers of the first decade.

Give each child 6 markers such as small stones, corks, pieces of shell macaroni, or plastic disks. Ask the children to make a group of 2 with the markers, and then to join another group of 2 to the first group. Be sure the children arrange the markers so that the groups of 2 are easily seen. Ask them how large the group is now. They should recognize it as a group of 4. Let them spend a few minutes combining and separating the two groups of 2. Then have them push the 2 markers they have not used over to the group of 4 to make a group of 6. Be sure they recognize it as a group of 6. If necessary, let them count the markers to verify that it is a group of 6. Have the children spend some time separating the markers into groups of 2, bringing them together one group at a time and separating them again so that they see 2, 4, 6, 4, 2 markers over and over.

When you are sure the children know that a group of 4 is formed by joining two groups of 2, and that when a group of 2 is joined to 4 a group of 6 is formed, and that they are able to recognize a group of 6, have them arrange the markers once more into three groups of 2. Now have them push each group of 2 apart so that as they are separated two groups of 3 are formed. Be sure the children recognize the groups of 3 and realize they were formed by taking one marker from each group of 2. Then have them combine the two groups of 3 again. Try to get the children to say that this is another way to make a group of 6. If

they have difficulty, help them by asking: "How many groups of 2 did we have? When you put three groups of 2 together, how big is the group you make? When you put one of each group of 2 on one side of your desk, and the other of each group of 2 on the other side of your desk, how many groups did you make? How many markers are in each group?"

"Have you used all the markers? Is there a marker in the group on this side of your desk for every marker on the other side of your desk? Then are the two groups the same size? Now push the two groups together again. How many markers are there in the group you just made? If you put two groups of 3 together, how many are there in the group you make? Is this the same number you get when you put three groups of 2 together? If you separate the group of 6 into two groups of the same size, how many are in each group?" Encourage the children to make these groups with their markers as they answer the questions. Now have them make groups of 3 in another way. Have them push one group of 2 to one side of their desks and another group of 2 to the other side. Then have them push one of the 2 markers from the third group to one group of 2 and the other marker to the other group of 2. Say "How many are in each group now? How did you make these groups of 3?"

These activities can be varied by having the children act out situations in which they can form groups. For example, a group of 4 children sitting at a table can be joined by a group of 2 children, or three pairs of children can separate into two groups of 3 or a group of 4 and a group of 2. Give such directions as: "Nancy and John, sit at the table. Now Mary and Jim, sit across from Nancy and John. How many children are sitting

at the table? Don and Carol, sit at the table, too. Now how many children are sitting at the table? If Nancy and Mary and Don leave the table, how many children will still be sitting there? (If necessary, have the 3 children leave the table.) Are there as many children still sitting at the table as there are children who left the table?" If the children can originate the directions and questions, let them do so. Let them practice combining and separating groups of 2 and 3 in as many ways as they can until you are sure they are able to see 6 as 2,2,2; 4,2; and 3,3.

[Worksheets 20 and 21 may be used at this point.]

Next, give each child 8 markers. Use the same procedures you used in developing groupings for 6. First have the children join a group of 2 to a group of 4 and recognize this as a group of 6. Then have them join a group of 2 to the group of 6. They must learn to recognize this as a group of 8. Let them count the markers, if necessary. When they understand that joining a group of 2 to a group of 6 forms a group of 8, have them manipulate the markers in groups of 2 until they see 8 as 2,2,2,2, and until they understand the sequence of 2, 4, 6, 8, and the reverse 8, 6, 4, 2.

Then develop 8 as 4,4, first by having the children separate four 2's into two equal groups and rejoin the groups to form 8, and then by having them make two groups of 4 each by combining groups of 2 and combining these groups of 4 to make 8. In each case have the children separate the groups into the subgroups from which they started so that they develop equal facility in combining groups and separating them into subgroups. Finally, let the children practice combining and separating markers in all of the above groupings until they dem-

onstrate that they are able to see 8 as 6,2; 2,2,2,2; 4,2,2; and 4,4, and until they understand the sequence of the even numbers 2, 4, 6, 8.

[Worksheets 22 and 23 may be used at this point.]

Next, give each child 10 markers. Using the same procedures described above, introduce 10 as 8,2; 4,4,2; 2,2,2,2,2; and 5,5. Start by having the children combine two groups of 2 markers to make a group of 4, bringing another group of 2 over to the 4 to make 6, then joining another group of 2 to the 6 to make 8. Finally, after this review of groupings that the children know, have them join another group of 2 to the group of 8 to form a group of 10. Let the children count the markers, if necessary. Be sure they understand that when 8 is joined by a group of 2, a group of 10 is formed, and that they learn to recognize a group of 10. Then have them separate the 8 into two 4's, join a group of 2 to the two 4's, and get the children to see that a group of 10 is formed. Next, develop 10 as 2,2,2,2,2, and introduce 10 as 5,5 by having the children separate the five groups of 2 to form two groups of 5. Let them practice combining subgroups to form 10 and separating 10 into subgroups until they demonstrate that they have learned to see 10 as 2,2,2,2,2 and 5,5 and that their understanding of the sequence of the even numbers of the first decade now extends to 10.

[Worksheets 24-26 can be used at this point.]

Vary the materials for these activities as much as possible by using different kinds of markers or by having one child combine and separate groups of small toys, such as little automobiles or toy animals, according to directions given him by the others.

Try to give each child a chance to participate in each arithmetic period.

## 20 Comments

On this page the children make groups of 6 by combining groups of 4, 2; 2,2,2; and 3,3.

The pictures on this worksheet have either one or two groups of objects printed in blue and several groups of objects printed in black. The children are to combine with the group (or groups) of blue objects as many groups of black objects as are necessary to make a group of 6. If there are two groups of 2 objects each printed in blue, they must select a group of 2 black objects and draw a ring around the three groups. In the first picture the children have a choice of two groups printed in black. For all other pictures there is only one selection of groups of black objects. Be sure they understand that all the blue objects in each picture must be used and that whole groups of black objects must be used.

Introduce the page by drawing the groups in the first picture on the board. Any type of object may be used as long as the position of the objects is the same as those in the book. The two groups that are blue in the book should be drawn in colored chalk. Ask the children how many objects are in the groups that are drawn in color, then ask them to find another whole group that could be put with them to make a group of 6 in all. Draw a ring around the three groups to show them what they are to do on the page. Discuss the fact that they have a choice of two groups, either of which could be put with the colored objects to make a group of 6. Show them how to draw a ring around each of the correct sets of three groups. Leave the picture with either of the correct sets of groups still circled on the board while the children work. Discuss the second picture without reproducing it on the board; then

let them finish the page independently.

If the less able children have trouble with this exercise, let them use markers. Give each child 6 markers and tell the children to put a marker on each blue object in the picture. Then tell them to put the rest of the markers on the black objects in such a way that all the markers are used and are on whole groups of black objects. Have them draw a ring around all the groups that have markers on them. After they have used markers with several pictures, encourage them to try to make groups of 6 without using markers.

This page may be checked by using a tissue overlay showing the two correct answers for the first picture and the single correct answer for each of the other pictures.

## 21 Comments

On this page the children identify groups of 4,2; 2,2,2; and 3,3 as a group of 6.

The blue strip of pictures from page 19 is used with this page. Use the same technique for this strip as that given in the directions for page 7 (pages 6-7 in this *Teaching Guide*).

On the preceding page the children exercised choice in the selection of subgroups that would make a group of 6. In the work for this page, they must decide whether or not the groups shown would make a group of 6. If the children think the groups make a group of 6, they make the mark for "Yes" (X) in the response square in the corner of the picture; if they think the groups do not make a group of 6, they make the mark for "No" (≠) in the square. They should decide quickly by merely looking at the groups. Much of the value of teaching children the fundamentals of arithmetic by grouping depends on

their learning to recognize these groups instantly without counting.

Introduce the page by putting 6 objects large enough to be seen by the whole class on a table in front of the room. Six little toy pails, or pails made of paper cups with paper handles, would be ideal, but if these are not available, other objects such as books could be used. First put 2 objects on the table and ask one of the children how many there are. Next, put another group of 2 near the first group and ask how many are in the second group and how many in all. Put down 2 more and repeat the above question. Continue this activity, both combining and separating groups, until you have shown 6 as 2,2,2; 4,2; and 3,3 several times. Then ask them to open their books and show them how to use the blue strip. Make the two response marks, X and ≠, on the chalkboard, and remind the children that they mean "Yes" and "No." More than one arithmetic period may be devoted to this page. (If the blue strips have been cut from page 19, be sure to collect them if they are to be used again.)

If the slower children have difficulty in recognizing groups of 6, let them use markers with the first strip of pictures, or with several strips, if necessary. Give the children 6 markers each, and have them put a marker on each object in the blue picture. Then tell them to put the remaining markers on the objects in the white picture. Make them understand that if they have used all the markers, and if every object in the blue picture and every object in the white picture has a marker on it, they have a group of 6. If they have any markers left over, there are not 6 in all. If they use markers in this way, it would be best to have them cut off the blue strip and lay it flat on the page, rather than to fold back the page with the

blue strip and try to hold it in position. After the children have used markers with some of the exercises, encourage them to finish the page without markers. If markers are still needed, continue to use them.

A tissue overlay like that suggested for other worksheets may be used to check this page.

## 22 Comments

On this page the children make groups of 8 by combining groups of 4,4 and 2,2,2,2.

This page is the same in purpose and technique as page 20, except that it deals with subgroups of 8 instead of subgroups of 6. The "Comments" for page 20 apply to this page also.

Have the children look at page 20, and ask them if they remember what they did on that page. Then have them turn to page 22. Tell them that they are to make a group of 8 by drawing a ring around all the blue objects and whole groups of black objects in each picture. All the blue objects must be used and as many groups of black objects as are needed to make 8.

In the last two pictures on the page (showing pennants and wagons), the children have a choice of two correct ways of making groups of 8. In all the other pictures there is only one correct selection of groups. The quickest way to check the page is to compare the children's work with the page in your book on which the correct groups have been encircled.

## 23 Comments

On this page the children identify groups of 4,4 and 2,2,2,2 as a group of 8.

This exercise gives the children practice in recognizing and identify-

ing two of the possible subgroups of 8. They are required to know not only that the whole group is a group of 8, but also to identify the subgroups as either 4,4 or 2,2,2,2. The exercise is divided into two parts, separated on the page by a heavy blue vertical line. (The blue strip at the right of the page is to be used later with page 25.) The key picture in each part is printed in blue.

In the first part of the exercise the children look at the key picture and note that it shows 8 balls arranged in two groups of 4. They must decide whether each of the other pictures in that section of the page (printed in black) shows two groups of 4 balls. If a picture clearly shows two groups of 4, they are to put an X in the blue response square in the corner of the picture. If it shows any other arrangement, they are to put a  $\Xi$  (scribble) in the square. Make it clear to them that the balls must be arranged in two groups of 4.

The blue key picture for the other part of the exercise (at the right of the blue line) shows 8 tops arranged in groups of 2. The procedure is the same, except that the X is to be placed in the response square of the pictures that show 4 groups of 2, and the  $\Xi$  in the response square of the pictures that show any other arrangements. Tell the children that all the pictures on the page show 8 objects.

Introduce the page by reviewing the equal subgroups of 8. Let the children use markers on their desks, or large objects on a table in front of the room. A few minutes' review should be enough. This page can be checked by using a tissue overlay.

## 24 Comments

On this page the children make groups of 10 by combining groups of 5,5; 2,2,2,2,2; and 4,4,2.

This page is the same in purpose and technique as pages 20 and 22, except that it deals with the subgroups of 10. The "Comments" for page 20 apply to this page also.

The children are to form groups of 10 objects in each picture by drawing a ring around all the blue objects and entire groups of black objects. All the blue objects must be used and whole groups of black objects must be used.

Introduce the page by reviewing briefly the subgroups of 10. Let the children use markers on their desks, or use large objects on a table in front of the room. Explain that they are going to use this page in the same way as they used page 20.

In the picture of the sandwiches, there are two correct ways of making groups of 10. In the other pictures there is only one correct selection of groups. This page may be checked by using a tissue overlay.

## 25 Comments

On this page the children identify groups of 4,4,2; 2,2,2,2,2; and 5,5 as a group of 10.

The blue strip from page 23 is used with this page. The technique for using this strip is the same as that given in the directions for using page 7 (pages 6-7 in this *Teaching Guide*).

The purpose of this page is the same as that of page 21, except that here the children work with groups of 10. The "Comments" for page 21 apply to this page also.

## 26 Comments

On this page the children combine subgroups to make groups of 6, 8, and 10.

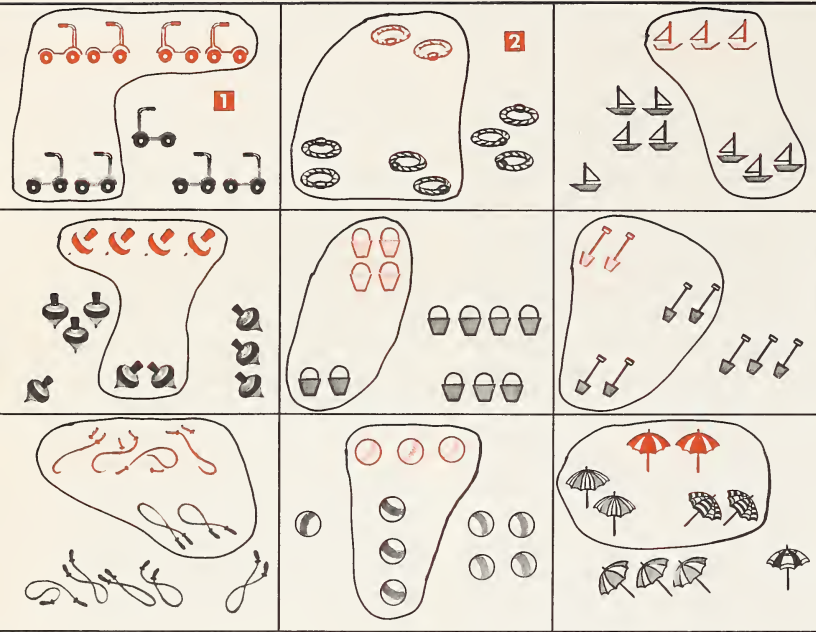
This worksheet, which is the last one in this group of pages, gives the children further practice in combin-

ing subgroups to make groups of 6, 8, and 10. There is a group of objects printed in black in each corner of each of the four pictures on the page. In the center of each picture is a large, random group of objects printed in blue. The tops are to be put in groups of 6, the balls in groups of 8, and the rings and blocks in groups of 10. The children are to look at a group of black objects, decide how many objects must be combined with it to make a group of the required size, select that number of blue objects, and draw a ring around the two groups. This exercise differs from other exercises of the same sort in that some of the groups of black objects already have the required number of objects in them. The children must recognize that such groups are already complete and respond by drawing a ring around the black objects only.

Introduce the page by reviewing the subgroups of 6, 8, and 10 briefly. Put a group of 3 or 4 books or other large objects on a table where all the children can see them. Ask: "How many books are in this group? How many books must I put with them to make a group of 6? How many to make a group of 10? How many to make a group of 8?" Continue in this way until the children have reviewed all the subgroups of 6, 8, and 10.

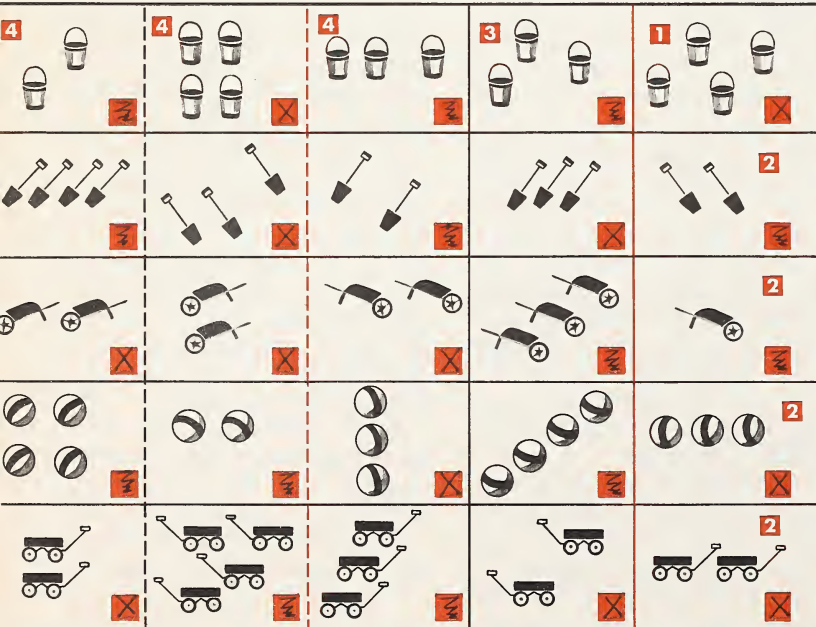
Since there are several correct choices for each picture, this page must be checked either as part of a class discussion or by examining each child's work, as you prefer.

Any weakness shown in the children's understanding of the 6, 8, and 10 groups should be remedied at this point. They are ready to go on to the next set of lessons when they know the subgroups for these numbers.



1 Direct attention to the first picture. Ask the children how many groups of blue scooters there are, how many scooters there are in each group, and how many blue scooters there are in all. Ask them to find a group of black scooters which, when combined with the blue scooters, will make a group of 6. Explain that they are to draw a ring around all the blue scooters and a whole group of black scooters so that there are 6 scooters in the ring. Examine their work to be sure they understand what they are to do and that they are responding correctly.

2 Let the children do the other exercises on the page independently. They are to draw a ring around a group of 6 objects by using all the blue objects and as many groups of black objects as are necessary.



1 Have the children place the blue strip from page 19 on page 21 so that its right edge is against the solid blue line. Then ask them to look at the group of pails in the blue picture and in the white picture and decide whether the two groups together make a group of 6. If they think they do make a group of 6, the children are to put X in the blue response square. If they think they do not, they are to put  $\approx$  in the square.

2 Have the children respond in the same way to the other pictures in the blue strip and the white strip.

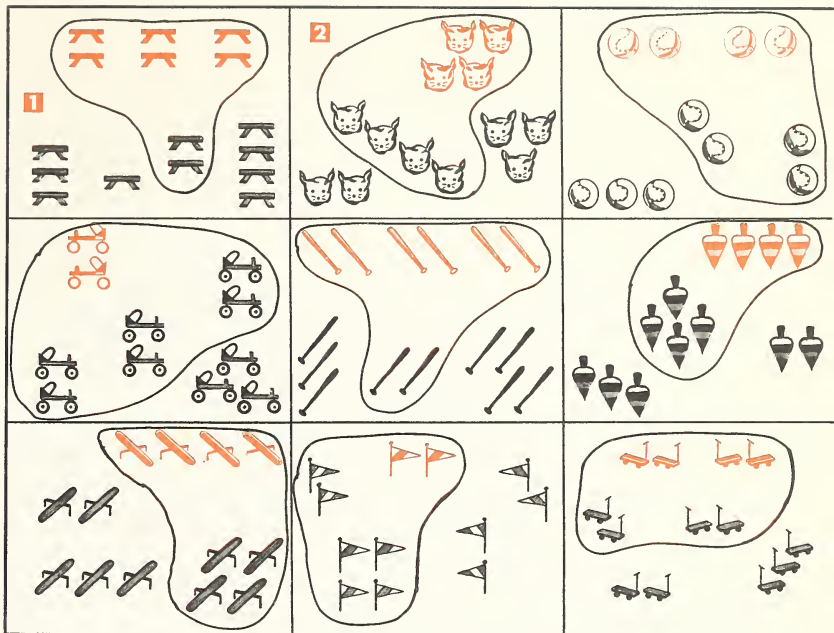
3 Have the children move the blue strip to the left so that its right edge is against the solid black line and respond in the same way.

4 The above procedure should be repeated and the blue strip used with each of the white strips on the page.

# 22

1 Direct attention to the first picture. Ask the children how many groups of blue benches there are, how many benches there are in each group, and how many blue benches there are in all. Tell them to find a group of black benches which, when combined with the blue benches, will make a group of 8. Tell them to draw a ring around all the groups of blue benches and a group of black benches so that there are 8 benches in the ring. Examine their work.

2 Have the children work independently on the rest of the pictures. Explain once more that they are to draw a ring around groups of objects by using all the blue objects and as many whole groups of black objects as are needed to make a group of 8.



# 23

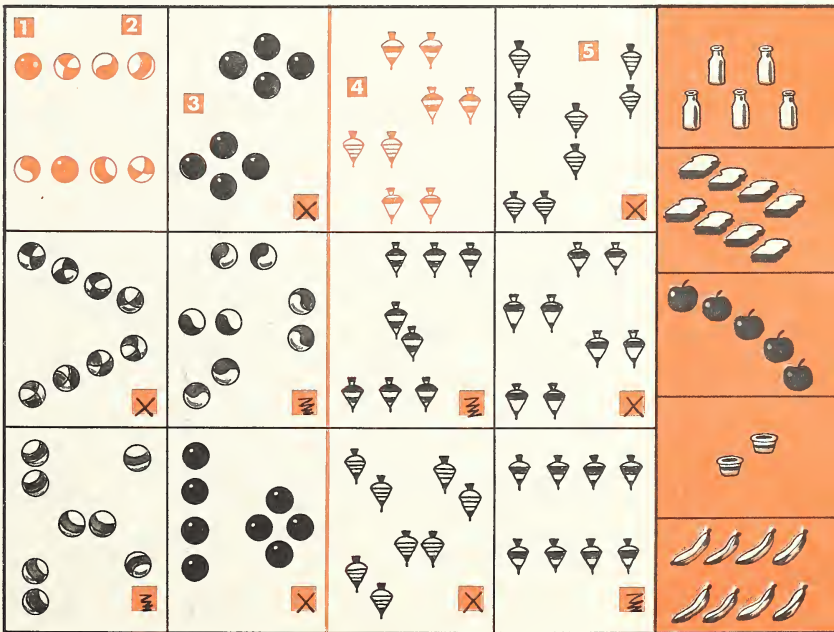
1 Tell the children that the heavy blue line divides the exercise into two parts. Explain that the blue strip at the right of the page will be used later with another page.

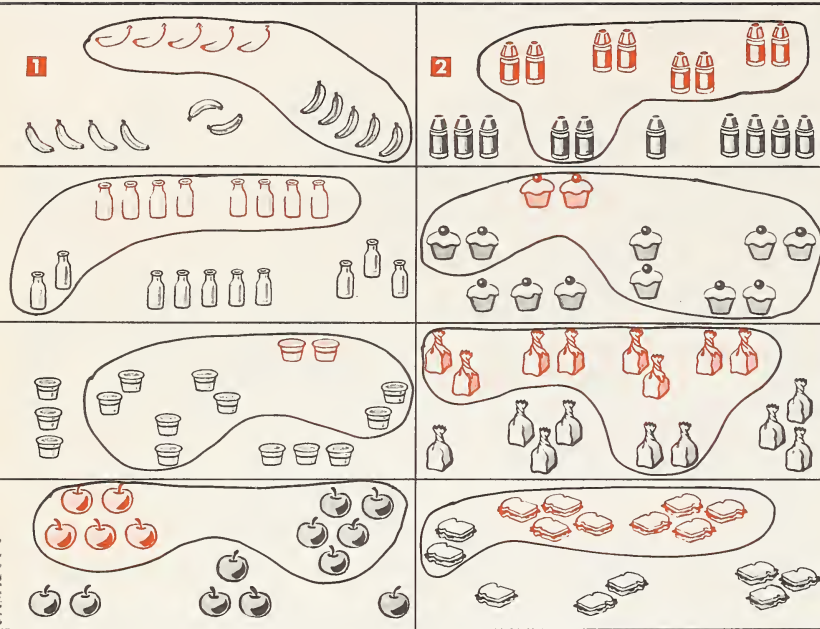
2 Tell the children to look at the first picture. Ask how many groups of blue balls there are and how many balls there are in each group.

3 Direct attention to the black pictures at the left of the heavy blue line. For each, the children are to decide if it shows the same number of groups and the same number of balls in each group as the blue picture. If it does, they are to put the mark X in the response square. If it does not, they are to make the mark  $\neq$ .

4 Have the children note that there are 4 groups of 2 tops in this key picture.

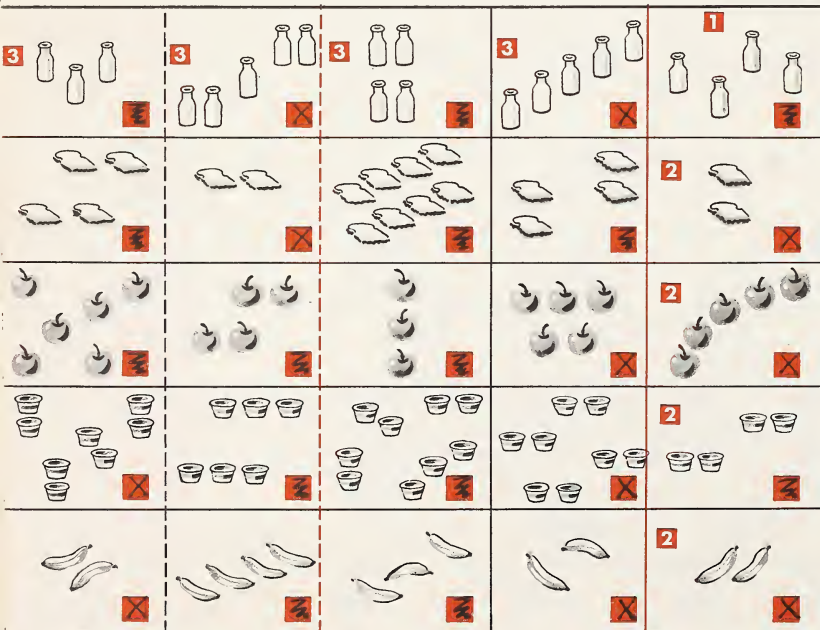
5 Adapt Note 3 for each black picture of tops.





1 Direct attention to the blue objects in the first picture. Ask the children how many groups of blue bananas there are and how many blue bananas there are in all. Tell them to find one or more groups of black bananas which, when put with the blue bananas, will make a group of 10 bananas. When they have decided which group of black bananas they are going to use, tell them to draw a ring around the groups of blue bananas and black bananas so that there are 10 bananas in the ring. Examine their work to be sure they are responding correctly.

2 Have the children work independently on the rest of the pictures. Explain once more that they are to draw a circle around groups of blue bananas and black bananas to make a group of 10, using all the blue objects and whole groups of black objects.



1 Have the children place the blue strip from page 23 on page 25 so that the right edge is next to the solid blue line. Ask the children to look at the bottles of milk in the blue picture and the bottles of milk in the white picture and to decide whether or not they make a group of 10 in all. If they do, the children are to put the mark X in the blue response square. If they do not, they are to make the scribble mark in the square.

2 Have the children respond in the same way to the other pairs of pictures formed by the blue key strip and the white strip.

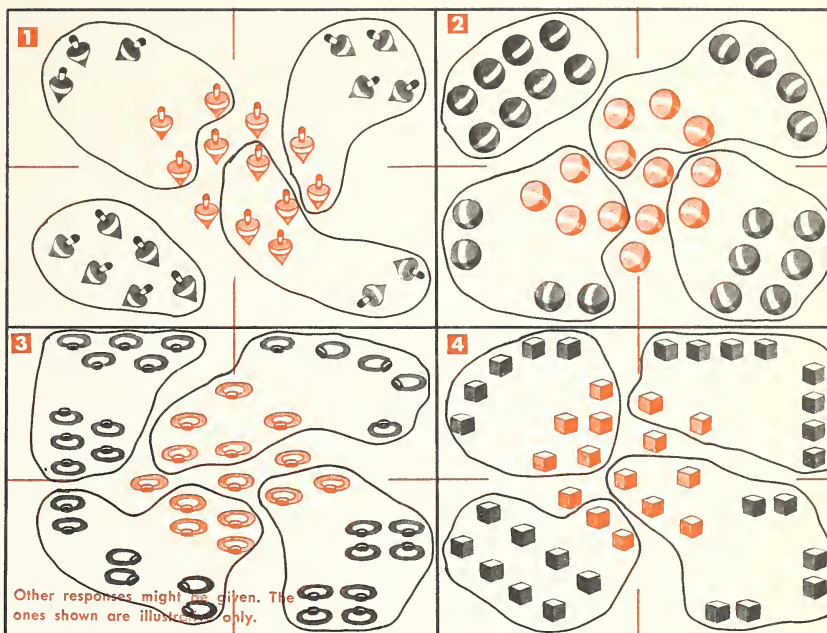
3 Have the children move the blue strip so that its right edge is against the solid black line and respond to the pairs of pictures in the same way. They should use the same procedure for each white strip on the page.

1 Tell the children they are to draw a ring around a group of 6 tops in each corner of the first picture. They are to use all the black tops and enough blue tops from the center of the picture to make a group of 6. Warn the children that some of the black groups may already have 6 tops without including any blue tops. In such cases they are to draw a ring around the black tops only.

2 For each corner, have the children draw a ring around all the black balls and enough blue balls to make a group of 8 balls.

3 Ask the children to follow the same procedure to make a group of 10 rings in each corner.

4 Have the children draw a ring around a group of 10 blocks in each corner.



## 27-32 SUBGROUPS OF 5, 7, AND 9

### Objectives

After the child has learned to recognize 6, 8, and 10 as combinations of groups of 2 and of equal subgroups, 5, 7, and 9 are introduced as combinations of equal subgroups and 1 more. The child learns that 5, 7, and 9 cannot be separated into two equal subgroups as the even numbers can. There is always one extra. Since he has learned to see 6, 8, and 10 as combinations of groups of 2 in an orderly progression, he has a good foundation for both the visual and the quantitative understanding of 5 as 2,2 and 1 more, 7 as 2,2,2 and 1 more, and 9 as 2,2,2,2 and 1 more. At this point, of course, he also is able to see 5 as 4,1; 7 as 6,1 and 3,3,1; and 9 as 8,1 and 4,4,1. Since there is only one other combination of groups that

forms 5 (2,3), it is included in this unit. Other component subgroups (the pairs of groups into which a number can be separated, or which can be combined to form a number) of 7 and 9 should not be introduced at this point. If some of the children notice the other combinations of component groups (7 as 3,4 and 9 as 5,4), they should not be stressed.

### Preliminary Teaching

Before using Worksheets 27-32, the children should be able to form groups of 5, 7, and 9 by assembling groups of 2 and one more, and by assembling 2 equal groups and one more, and to separate 5, 7, and 9 into these same groups. They should also be able to recognize groups of 5, 7, and 9 without counting.

The same types of activities suggested in the section on preliminary teaching for Worksheets 20-26 can be used for Worksheets 27-32. Have the children work with markers, small toys, or familiar classroom objects. Vary these activities by letting some of the children act out situations in which they can form groups or separate into groups while the other children give them directions or answer questions about the size of the groups or about how many children should join a group or leave a group to make another group of a certain size.

First, using markers, review briefly 6, 8, and 10 as combinations of groups of 2, and emphasize the fact that each of these numbers can be separated into two equal groups. Next, ask the children each to hold up one hand. Say: "How many fingers do you have on one hand? Is one of

the fingers different from the others (the thumb)? How many fingers show if you close your hand so that the thumb is hidden? Hold your hand so that the thumb is hidden. How many fingers are showing now? How many groups of two are there? Now show your thumb. When you add one extra to 2 twos, how many do you have?" Let the children show all the groups that make 5 (2,2,1; 4,1; 3,2) by the positions of their fingers. A variation of the game "Simon Says" can be used to give them more practice in forming groups of 5. Start by giving such directions as "Simon says put this hand up. Simon says show 4 and 1. Simon says show 3 and 2. Show 4 and 1, etc." Then give each child 5 markers and have him continue forming groups of 5 and separating them into subgroups until you are sure that he is able to see 5 as 2,2,1; 4, 1; and 3,2. During all these activities emphasize that, unlike 6, 8, and 10, 5 cannot be separated into two equal groups, that it is made by adding one extra to two groups of 2, or to a group of 4. Introduce 5 as 3,2 only after the children show that they see 5 as an even group with one extra.

[Worksheet 27 can be used at this point.]

Next, using the same type of activities with markers, small objects, or groups of children, introduce 7 as 2,2,2,1; 3,3,1; and 6,1. First, using markers, quickly review 5 as 2,2,1 and 4,1, always starting with 2's or 4, and adding one extra. Then give each child 7 markers. Have the children arrange them in 3 groups of 2 and one extra. Be sure they recognize this as a group of 7. Now have the children separate the three groups of 2 into two 3's and one extra, then make a group of 6 and one extra. Be sure they understand that 7 is like 5 in that it also is made by including one extra in a group that may be

separated into pairs or into two equal groups. It is important that the children be able to see this pattern of the uneven numbers just as they learned to see the pattern of even numbers. A good way to help the children understand the difference between even and uneven numbers is to let them play games in which they must use teams with the same number of children on each team and games in which there must be an extra child. "Last Couple Out" and "Puss in the Corner" require an even number of players and one extra player. All of the racing games need teams of an equal number. Be careful to keep the size of the groups of children playing the games within the numbers they have learned, and point out to them as they play each game what kind of group (one composed of two equal groups or one composed of equal groups with one extra) they are making. Do not use the terms *odd* and *even*. Try to get the children to see that they could not play a racing game with one extra person on a team, or play "Last Couple Out" with an even number of players.

[Worksheets 28 and 29 can be used at this point.]

Next, introduce 9 as 2,2,2,2 and one extra; 4,4 and one extra; and 8 and one extra. Use the same type of activities suggested above for the groups that make 5 and the groups that make 7, and point out that 9, like 5 and 7, is made by adding one extra to a group that may be separated into pairs or into two equal groups and that, like them, it cannot be separated into two equal groups. First have them make groups of four 2's and put one extra with it. Be sure they recognize this as a group of 9. If necessary, let them count the markers at this stage. Then introduce 9 as 4,4 and one extra, and 8 and one extra. Have the children use these sub-

groups to make groups of 9 and then separate 9 into these subgroups until they demonstrate that they are able to see 9 as 2,2,2,2,1; 4,4,1; and 8,1.

[Worksheets 30, 31, and 32 can be used at this point.]

## 27 Comments

On this page the children combine the subgroups of 2,2,1; 3,2; and 4,1 to make groups of 5.

The subgroups are combined by drawing rings around groups of black objects and drawing lines from them to a blue object in the center of each picture. As in other exercises where the children have responded by selecting groups, a group may not be used more than once and entire groups must be used.

Introduce the page by drawing on the board a simple container surrounded by groups of 2 and 3 objects and some single objects. A box or a basket may be used for the central object, and apples would serve very well for the groups. Ask one child to go to the board and encircle 2 groups of 2 and a single object and draw lines from the three rings to the center object. Explain that he is making a group of 5 and that he is putting the apples in the basket. After the children have discussed the work on the board, erase the rings and lines and ask another child to come to the board. Tell him to put 5 apples in the basket by using different groups. Repeat this procedure several times. Have the children look at page 27. Tell them that they are to draw rings around enough groups to make 5 objects, then draw lines from the rings to the object in the center of the picture, as they did with the groups drawn on the board.

If some of the slow learners have trouble, give them 5 markers, and let them arrange the markers on the

black objects. They should remove the markers before they draw rings around the groups. After they have done several of the exercises in this way, they should be able to complete the page without using the markers. Be sure the children understand that they may use any combination of subgroups as long as they make a group of 5.

Since the groups are arranged so that the children have more than one choice in every picture, each page must be checked individually.

The blue strip at the right of the page is to be used later with Worksheet 29.

## 28 Comments

On this page the children combine the subgroups 2,2,2,1; 3,3,1; and 6,1 to make groups of 7.

This worksheet is like page 27 in technique and purpose except that the children are to combine subgroups to make groups of 7 instead of groups of 5. They are to draw rings around whole groups of children and draw lines from the rings to the object printed in blue in each picture. One child by himself is to be considered a group, but the children in groups of 2 or more may not be separated. The total number of children in the groups combined in this way must be 7.

Introduce the page by reviewing the work done on page 27. Have the children look at page 27. Have them turn to page 28 and tell them they will do the same things on this page, except that they are to bring groups of 7 to the playground equipment in the center of each picture.

If some of the children need to use markers with the pictures, let them. After they have used markers and encircled the groups in two or three pictures, encourage them to try the exercises without markers.

Since there is more than one choice of groups that may be used correctly in each picture, either you must check each picture individually or have the children check their own papers. Discuss the different ways that groups of 7 can be made in each picture.

## 29 Comments

On this page the children identify groups of 2,2,2,1; 3,3,1; and 6,1 as groups of 7.

The blue strip from page 27 is used with this page. The technique for using it is the same as that given in the directions for using Worksheet 7 (pages 6-7 in this *Teaching Guide*).

This page is used in the same way as page 25, except that here the children are concerned with subgroups that make a group of 7.

On page 28 the children selected subgroups to make a group of 7. On this page, as on previous pages of the same sort, they do not select the groups. They look at pairs of pictures and decide whether or not the groups shown make a group of 7. If the children think the groups make 7, they put the mark meaning "Yes" (X) in the response square. If they think the groups do not make 7, the mark meaning "No" (N) is used. They should decide quickly, simply by looking at the groups. They should not count.

Remind the children of the work they did on page 25. Be sure they remember how to put the blue strip in position and work with it. Have the children tell you how they can tell a group of 7 from a group of 8 or a group of 6. Let one or two children demonstrate the difference between these groups by using books or other large objects.

If the slow learners have trouble with this page, let them use markers. Use the technique described in "Comments" for page 21.

A tissue overlay may be used to check this page.

## 30 Comments

On this page the children combine the subgroups 2,2,2,2,1; 4,4,1; and 8,1 to make groups of 9.

This worksheet is like pages 27 and 28 except that the children are to combine subgroups to make groups of 9. They are to draw rings around whole groups of objects and draw lines from the rings to the container printed in blue in each picture. The total number of objects in the groups combined in this way must be 9.

Introduce the page by having the children tell how 5 and 7 are alike and how they are different. Tell them that 9 has something in common with both 5 and 7. Draw a group of 5 on the board, and ask the children how many there are in the group and what they must do to it to make it a group of 7. Show them that joining another group of 2 to the group of 7 makes a group of 9. Have them look at the page and tell what they did with similar pages.

If any of the slow learners need to use markers in some or all of the pictures, let them.

Since there is a choice of groups that may be used correctly in each picture, you may wish to let the children check their own work while they discuss the ways of making a group of 9 in each picture.

## 31 Comments

On this page the children make groups of 9 by combining groups of 2,2,2,2,1; 4,4,1; and 8,1.

This page is the same in purpose and technique as pages 20, 22, and 24, but it deals with groups of 9.

The children are to form a group of 9 objects in each picture by draw-

ing a ring around all the blue objects and entire groups of black objects. All the blue objects must be used and as many groups of black objects as are needed to make 9.

Introduce this page by having the children make groups of 9 with markers or on the board in as many ways as they can think of. If any child shows 9 as 3,3,3, accept it as correct, but do not discuss it. Then have the children look at page 31 and tell what they are supposed to do. By now they should know what is required, and it should not be necessary to work through any exercises with them.

If necessary, let the children work out their groups with markers first. Be sure they remove the markers from the page before they make the rings around the groups.

Since there is more than one correct answer for several of the exer-

cises on this page, let the children discuss the ways of making 9 in each picture while they correct their own worksheets.

## 32 Comments

On this page the children review recognition of groups of 5 to 10.

This page is the last in this group of worksheets. It gives you an opportunity to evaluate the children's ability to recognize the groups they have been studying. If their performance is not satisfactory, be sure to devote more time to these groups before going on to the next block of work.

This page is divided into vertical strips, each with a key picture printed in blue at the top and under it three pictures printed in black. The children are to decide for each of the black pictures whether it shows a group of

the same size as the key picture. If it does, they are to put the mark X in the response square. If it does not, the mark  $\equiv$  should be made in the square.

Introduce the page by showing cards that illustrate groups of 5, 6, 7, 8, 9, and 10. Have the children tell how many objects are pictured on each card. Then have them open their books and identify each group shown in blue. Explain what they are to do, and let them work independently.

Children who have worked with markers up to this time should try to do this page without them. If they resort to counting to find the size of the groups, they need more practice in learning to recognize them.

This page may be checked by using a tissue overlay.

# 27

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Other responses might be given. The ones shown are illustrative only.

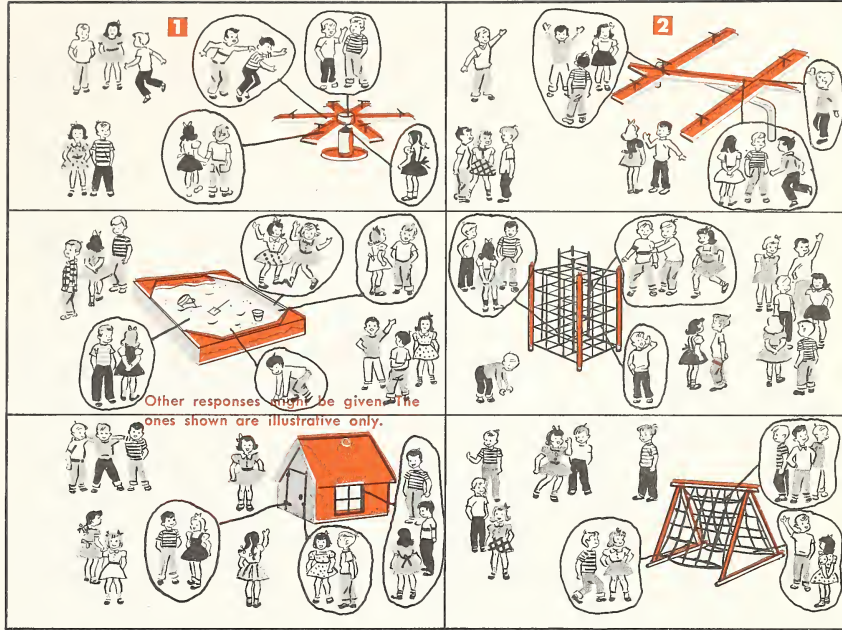
1 Direct attention to the dolls in the first picture. Tell the children that 5 of the dolls are to be put at the table by drawing rings around whole groups and drawing lines from the rings to the table. The dolls in a group may not be separated, but one doll may be encircled if it is alone. Be sure they understand that 5 dolls in all must be brought to the table. Examine their work to see that they are responding properly.

2 Have the children follow the same procedure for each picture. Explain again that enough whole groups of objects to make 5 in all are to be encircled and lines drawn from them to the single blue object. Tell them that the blue strip is to be used later with another page.

# 28

1 Direct attention to the groups of children in the first picture. Tell pupils that they are to put just 7 of the children on the blue merry-go-round. Explain that they are to draw rings around entire groups of children and then draw lines from these rings to the merry-go-round. Remind them that they can use a single child as a group if he is alone. Check their work to see that they are responding correctly.

2 Have the children follow the same procedure for each picture. Explain again that whole groups of objects that will make 7 in all are to be encircled and lines drawn from them to the single blue object.

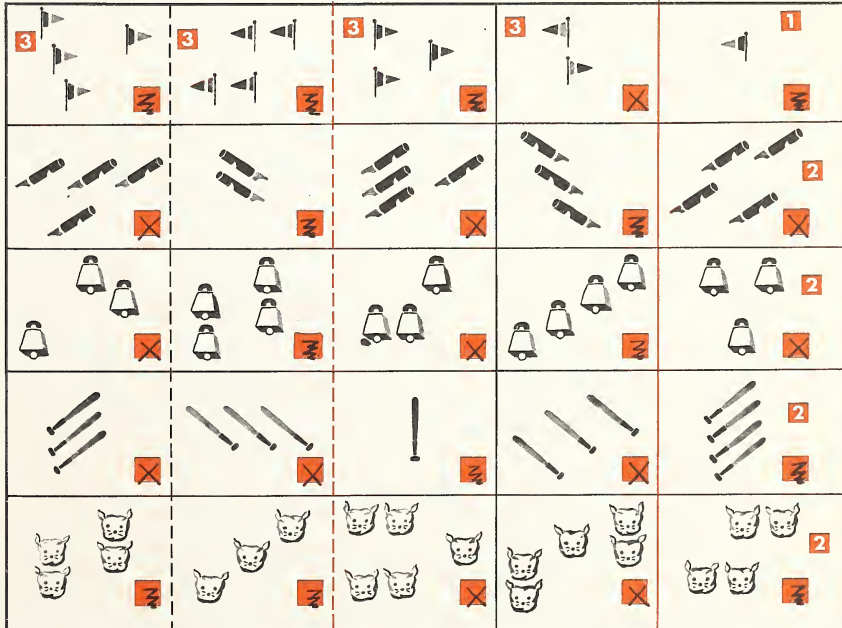


# 29

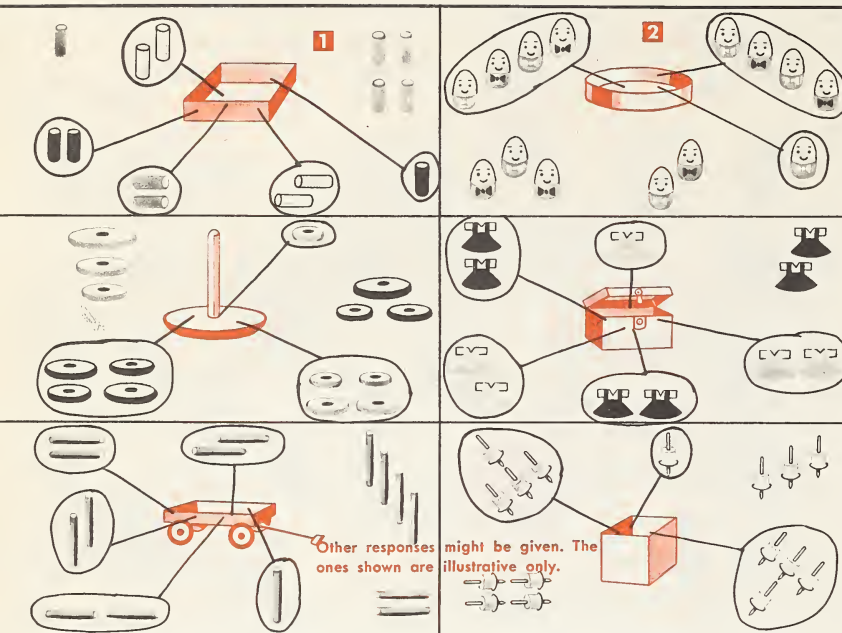
1 Have the children place the blue strip from page 27 on page 29 so that the right edge is against the solid blue line. Ask the children to look at the pennants in the first blue picture and in the first white picture and decide whether together they make a group of 7. If they do, the children are to make the mark X in the blue response square. If they do not, they are to make the mark  $\equiv$  in the square.

2 Have the children follow the same procedure for the other pairs of pictures.

3 Have the children repeat the procedure described in Notes 1 and 2 until the blue strip has been used with each of the white strips. If it is necessary to devote more than one arithmetic period to this exercise, be sure to collect the blue key strips if they have been cut from page 27.

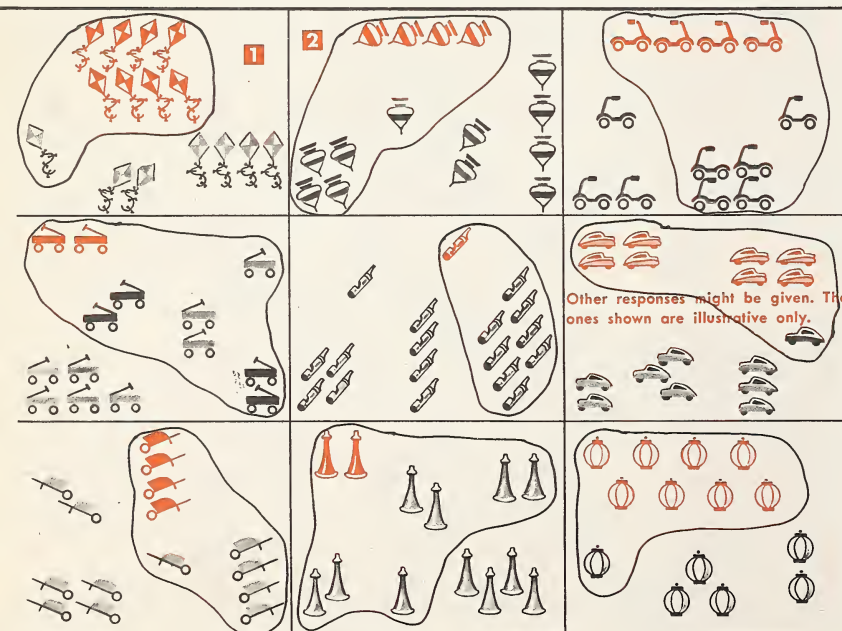


# 30



- 1 Direct attention to the groups of pegs in the first picture. Tell the children that they are to put just 9 of the pegs in the blue box in the center of the picture. Explain that they are to draw rings around whole groups of pegs to make 9 in all and draw lines from the rings to the box. Remind them that they can use a single object if it is by itself.
- 2 Have the children follow the same procedure for each picture.

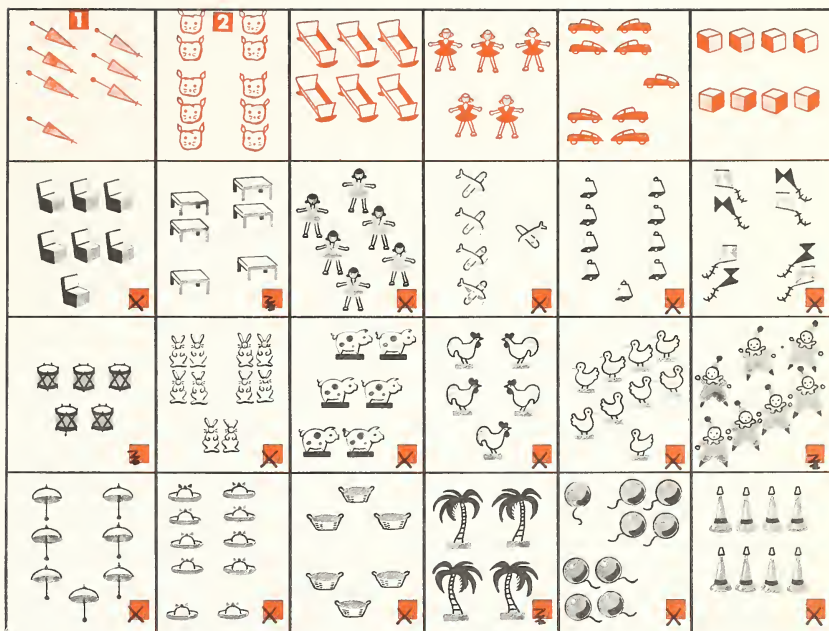
# 31



- 1 Direct attention to the blue kites in the first picture. Tell the children they are to find a group of black kites to put with the blue kites to make a group of 9 kites in all. Tell the children to draw a ring around the blue kites and enough black kites to make a group of 9 kites in all in the ring.
- 2 Have the children follow the same procedures with the rest of the pictures, using all the blue objects and whole groups of black objects to make groups of 9.

1 Direct attention to the picture of the blue umbrellas. Ask the children to decide how many umbrellas there are, then to look at the pictures printed in black under the umbrellas and for each decide if there is the same number of objects as there are in the picture of the umbrellas. If there is, they are to put an X in the response square. If there is not, they are to make the scribble mark in the square. Be sure they understand that the arrangement of the groups need not be the same, but the number of objects must be the same. Check to see that the children understand what they are to do.

2 Ask the children to follow the same procedure for each of the other strips of pictures.



## 33-37 THE UNIT IN MEASUREMENT

### Objectives

All objects can be compared by describing their dimensions (length, width, depth, height) in terms of standard units of measure. Before the child can understand measurement as expressed in terms of *inch*, *foot*, *yard*, he must recognize the need for standard units. He must also develop the skills he will need to use the tools of measurement.

The child has already had some experience with ideas of *tall*, *short*, *high*, *long* (Worksheets 9 and 10). His preparation for understanding measurement includes three more stages. First, he must learn to compare many objects to the same object (a stick of any convenient length will do) and note whether they are longer, shorter, or about the same length as the stand-

ard object. Then he must learn that greater lengths may be measured by using many objects (sticks) of the same length, placing them end to end, and counting how many are needed. Finally, he must learn that he can use one stick instead of many by using it over and over and counting the number of times it is used. During each of these three stages he must grow accustomed to the inexact nature of measurement. He must learn to express measurements as a little longer or shorter than the object he is using as a standard.

### Preliminary Teaching

Before using Worksheets 33-37, the child must learn to make approximate comparisons of length as preparation for the idea that no measure is

exact, and also develop the manipulative skills necessary in measurement.

Ask several of the children to come to the front of the room. Have them stand a few feet apart, and let the rest of the class take turns judging which child is tallest, which children are almost as tall, and which is the shortest. Then say: "Now let's see if you are right. Jack (the child they decided was the tallest) come to the board. [Make a mark on the board to show how tall Jack is.] How can we use this mark to find out if Jack is really the tallest? [The children should suggest that the other children whose heights are being judged stand at the board so that their heights can be compared with Jack's height.] Who do you think the shortest child in the class is? Who do you think is the tallest child in the class? Do you think David is taller than Jack? David,

stand beside the mark that shows how tall Jack is."

Have other groups of three or four children come to the front of the room. Select children who vary noticeably in height, and let them practice estimating their own heights. They should say something like: "I am almost as tall as Jack" or "I am a little taller than Jean."

Next, put a strip of colored paper about 8 inches long on the bulletin board. Prepare strips of paper, some of which are about the same length as the strip on the board and some of which are shorter or longer. Give each child several of these strips. Ask the children to find among those on their desks a strip that is about the same length as the strip on the board. Let them compare the strip they chose with the one on the board and with the strips that other children have chosen. Get them to see that two strips of different lengths may be almost the same length as the strip on the board. Let them try to find strips that are shorter and longer than the strip on the board in the same way. Watch to see that they develop judgment about the strips they select.

Carry out similar activities with pieces of chalk, pencils, and other objects in the room that can easily be compared for length. Continue these activities until the children show that they are able to make approximate judgments of length with ease and comfort.

Next, using a stick or dowel rod about 5 inches long [any convenient length will do], let the children take turns measuring the length of the chalkboard erasers, books, boxes, and other small objects to see if they are as long as, shorter than, or the same length as the rod. The purpose of this activity is to develop their skill in manipulating the measuring instrument. They should not use rulers for

this purpose because they need to be shown that measuring can be done in terms other than feet or inches. They should be able to place the stick so that one end of it and one end of the object they are measuring coincide, and so that the stick is held firmly against the edge of the object in a straight line. It would be well to provide sticks for as many children as possible to work at the same time.

[Worksheet 33 can be used at this point.]

Next, using several sticks or dowel rods about 15 inches long [any convenient length will do, but be sure the sticks are all the same length], let the children take turns measuring the length of the window sills, the width of the door, the length of the bulletin board, chalkboard, etc., by placing the sticks end to end along the edge of the object they are measuring and counting the number of sticks they use. Be sure that the children place the sticks in a straight line end to end, without gaps between the sticks and without overlapping. Each time they measure an object, have them describe the length as "a little longer than two sticks," "not quite three sticks long," etc.

Give each child 5 two-inch sticks and 2 markers. First let them practice measuring books, sheets of paper, their crayon boxes, etc., until they are able to place the small sticks end to end in a straight line carefully and easily. Then let them measure the objects and compare the various lengths. For example, have each child measure his own reader to see if all the readers are the same size, or have each child measure a book from the bookshelf to see how much larger or smaller it is than his reader. Then have the children put one of the two markers slightly to one side of their desks and give directions such as: "Put the other marker three sticks

from the first. Now put it five sticks from the first. Be sure the sticks are in a straight line. Now put the markers four sticks apart."

Another good activity is to have the children arrange the markers as they wish and then measure the distance between them. Ask, "John, how far apart are your markers? Did anyone else put the markers two sticks apart? Alice, how far apart are your markers? How many of you put the markers a little more than five sticks apart?"

[Worksheet 34 can be used at this point.]

Give each child 2 two-inch sticks and a sheet of  $8\frac{1}{2}$ " x 11" paper. Ask them to measure an edge of the paper with the sticks. When they discover that there are not enough sticks, ask them if they can think of any way to measure the paper, using only the sticks they have. Let them discuss the problem until one of them suggests using the same sticks over and over. If necessary, help them by asking questions like: "Are the sticks the same size? Could we use any stick in place of any other stick? Could we put the two sticks down and then use them over again? How could we tell where to put the sticks if we used them over again? Could we use just one stick over and over? How would we know exactly how many times the stick has been put down, and how would we know exactly where to put it each time?" Show the children how to measure the papers by using one stick, making a mark at the end, and placing the stick with one end touching the mark. Watch to see that they put the sticks exactly against the marks and keep them in a straight line. When they have finished, let them count the spaces between the marks to see how many times they put the stick down.

Next, give such directions as: "Make a mark with a pencil just three

sticks from the edge of the paper. Now make a mark with the pencil a little more than two sticks from the edge. Use a different part of the paper this time. Now move the stick down a little and make a mark a little less than three sticks from the edge." Let the children compare their marks and discuss any differences they find. Try to get them to develop judgment about "a little more than" and "a little less than."

It is important that the children realize that their measurements cannot be compared unless they all use the same unit of measure, and that it is more convenient to use a long unit when the object measured is long. Ask one of the children to come to the front of the room and measure the top of the table. Say: "Do you want to use the little stick you have been using to measure sheets of paper? Why not? Would you rather use one of these?" Offer a choice of sticks of varying lengths, ranging from about 8 inches to about 4 feet. Let the child select a stick and do the measuring. Then let several pairs of children perform the same activity, using sticks of different lengths. Ask questions and make remarks that will make the children observe that the same object can be two sticks long, three sticks long, or five sticks long, and keep the discussion going until someone remarks that the longer the stick the fewer the number of times it must be put down.

Continue the discussion until the children show that they understand why it is necessary to use a common unit of measure if two measures are to be compared. This idea can be developed by distributing short sticks of various lengths among the children and having the children use them to measure objects of the same size, such as sheets of paper, their books, or their crayon boxes. Let them com-

pare results and discuss the variations in the answers and the reasons for them.

[Worksheets 36 and 37 can be used at this point.]

## 33 Comments

On this page the children use a measuring tool, which they accept as a standard unit to find out whether the object measured is longer than, shorter than, or the same size as the measuring tool.

Introduce this page by holding up a stick of any length and asking the children to look around the room to see if they can find any objects they think would be longer than the stick. Then ask if they see anything in the room that is shorter than the stick. Finally, ask if there is anything that they think is the same length as the stick. (Be sure there is.) Have each child who mentions an object take the stick and measure the object to find out if he is right.

Each child will need a stick or piece of cardboard 2 inches long to measure the objects on the worksheet. This is the unit of measure to be used for this page and the following four pages. This length was selected for convenience only. A shorter stick would be too hard to handle, a longer one would limit the number of objects that could be pictured on the page. The actual length of the sticks is of no importance.

In each picture there is a brown doll. The position of the doll indicates whether the dimension the child is to measure is the height or the length of the object. The familiar response marks, ● for *more than*, ○ for *less than*, and =, are to be used. In each picture the children are to determine whether the object is longer than, shorter than, or equal in length to the stick.

If some groups of children have difficulty in remembering the directions, let them go over the page three times. First, they might find and mark all objects that are longer than the stick, then find and mark all objects that are shorter than the stick, and, finally, find and mark all objects the same length as the stick.

This page may be checked by using a tissue overlay.

## 34 Comments

On this page the children measure by placing sticks of the same length end to end in a straight line on the object being measured, and counting the sticks. The lengths of the objects to be measured are multiples of the length of the stick.

Measuring in this way is the second step in preparing the child for measurement. On the previous page he learned to use a standard measuring tool (an unmarked two-inch stick) on a number of different objects to determine whether they were longer than, shorter than, or the same length as the stick. Now he learns that greater lengths can be measured by using many sticks of the same length, by placing them end to end, making a tally mark for each stick, and then counting the tally marks. He must learn to place the sticks end to end neatly, and he must understand that the results are less accurate if he does not.

Introduce the page by asking the children to tell you three things they must do if they are going to measure an object accurately. See if they can tell why these are necessary.

Each child will need 5 two-inch sticks. When you give the children the sticks, ask if the sticks are all the same length. Have them line the sticks up side by side, so that they can see that they are.

The objects printed in black on this page are to be measured by placing a sufficient number of sticks end to end along either the length or height of each object. The position of the brown doll in each picture indicates the dimension to be measured.

## 35 Comments

On this page the children measure by using the same stick repeatedly and counting the number of times it is used. The lengths of the objects to be measured are all multiples of the length of the stick.

Measuring in this way is the third step in preparing the child for measurement. He learns to measure by putting one stick down as many times as necessary along the line to be measured and counting the number of times it is used. He must learn to be precise about placing the stick on the line. The first time he puts it down he must be sure that one end is at the beginning of the line and he must make a mark at the other end. This procedure is repeated until he has put the stick down as many times as he can along the line. He finds out how long the line is in terms of the stick by counting the number of times he has put the stick down.

Introduce this page by asking the children if they can think of any games they might play that would require them to do some measuring. Let them mention two or three games and tell why measuring is necessary.

This page may be checked by listing the number that should be encircled on each picture or by discussing the children's answers.

## 36 Comments

On this page the child measures a given length by using the same measuring tool over and over.

In most daily activities measurement is used for one of two different purposes. Either we measure to find out how long or how high or wide something is, or we measure to find a given portion of something. For example, we measure to find out how tall a person is, how long or how wide a room is, or how long a table is. We also measure three yards of dress material so that it may be cut from the bolt, four- or five-foot lengths of board to be cut for shelves, or fifty feet of wire for a fence.

On this page the children get their first practice in measuring to find a certain length on a line. The brown numeral at the beginning of each line tells how many lengths of a two-inch stick they are to find (how many times the stick is to be put down on the line), and the small vertical brown mark at the beginning of the line shows where to start measuring.

Introduce this page by asking the children if they ever tried to keep track of the distance they rode on their bicycles or of how far they roller-skated or hiked. They will probably say they rode or skated or hiked so many blocks. Draw a line on the board and write a numeral at the left of it. Show the children exactly what they are to do. Tell them to make a large, clear mark at the end of the section of line they measure. They should be able to do all the work on the page independently. Observe their work to be sure they understand and are doing the exercise correctly.

This page can be checked by using a tissue overlay showing the beginning of each line and the mark at the end of the segment measured.

## 37 Comments

On this page the child measures lines that are greater or less than multiples of the length of the measuring stick.

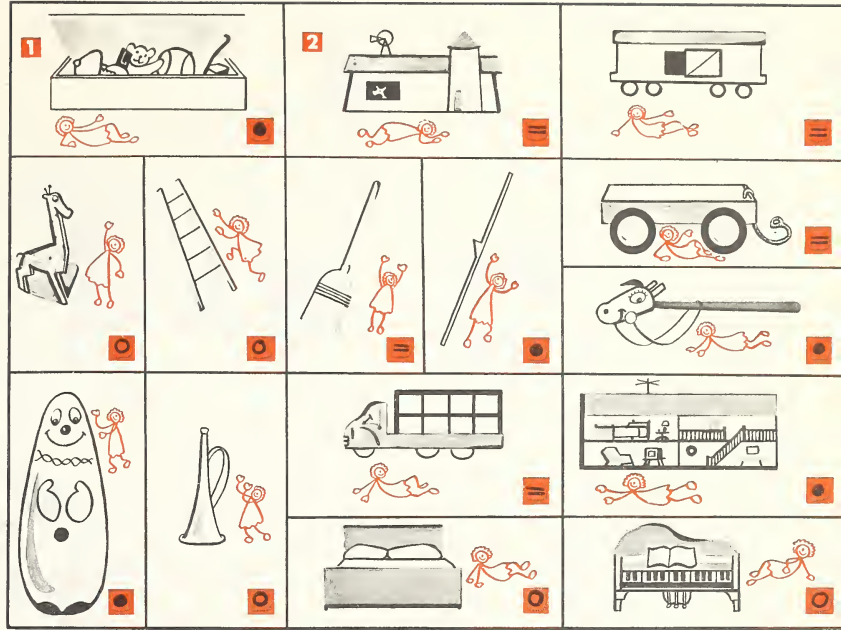
On the immediately preceding pages the children measured only lines or objects whose lengths were exact multiples of the measuring stick. On this page, for the first time, they measure lines of lengths not multiples of the length of the stick. They measure to the nearest number of sticks and tell what the number is and whether the line is shorter or longer than that number of sticks. The page was planned so that the length of each line to be measured is either a little less than or a little more than a certain number of sticks.

To introduce this page, draw several lines of different lengths on the board. Write numerals under them so that the lines will look like those in the book except for the animals and objects. Using a stick that is long enough for the children to see easily, show them what you mean by a little more than and a little less than the length of a stick. Measure the lines on the board, and have the children keep track of the number of times you put the stick down on each line. Let them decide whether each line is a little shorter than two sticks (or whatever the multiple of the measuring stick is). Let one of the children draw a ring around the correct numeral under the line. Explain that if the line is a little longer than a certain number of measuring sticks, the ring around the numeral is to be filled in; and if it is a little shorter, the ring is to be left as it is. When the second and third (and fourth, if necessary) lines on the board are measured, let the class decide whether or not the ring should be filled in. Then ask the children to open their books. Explain that on the first line they are to measure in the same way to see how far the bird flew from his house. With a group of slow learners it may be necessary to work through several of the exercises on the page.

# 33

1 Give each child a stick or piece of cardboard 2 inches long. Tell the children that they are to use it to measure the black object in each picture and that the position of the doll tells them whether they are to measure the height or the length. Ask the children whether they are to measure the length or the height of the box in the first picture. Tell them to put their sticks down on the picture so that one end of the stick is at one corner of the bottom edge of the box and decide whether the box is longer than, shorter than, or the same length as the stick. If the box is longer, have them put ● in the response square. If it is shorter, have them put ○ in the square. If it is the same length, have them put = in the square.

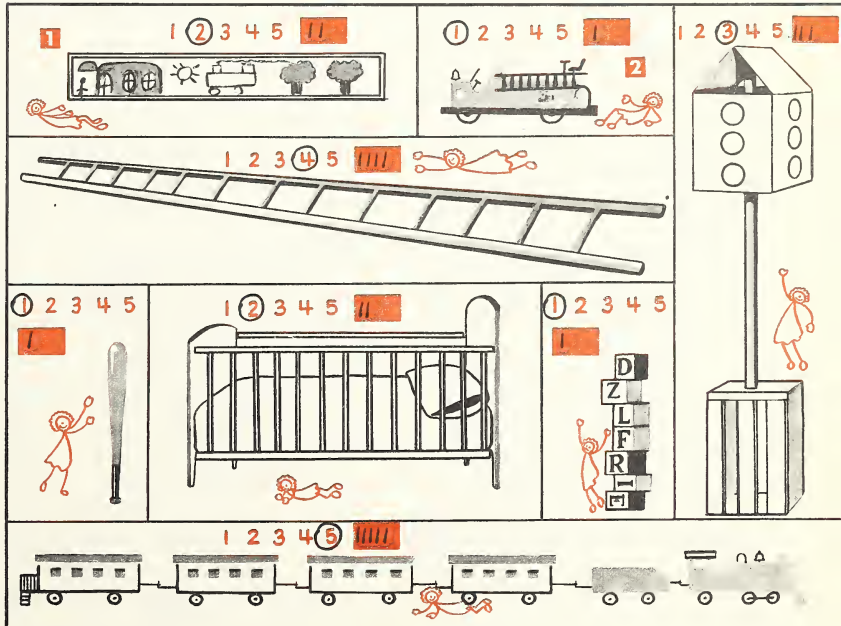
2 Adapt Note 1 for each picture on the page.



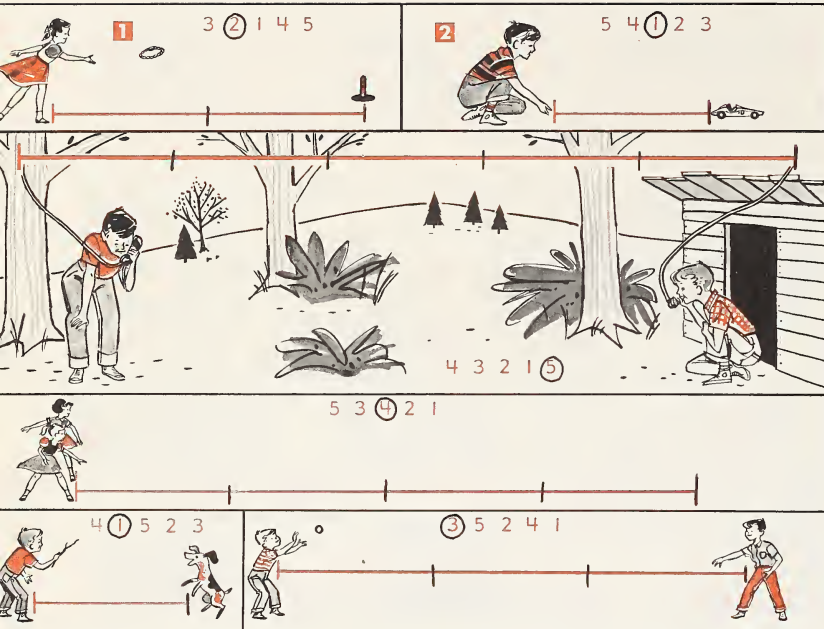
# 34

1 Give each child 5 two-inch sticks or pieces of cardboard. Tell the children that if the brown doll is lying down, they are to measure the length of the black object in the picture; and if the doll is standing, they are to measure the height. Have them place a stick along the bottom edge of the picture so that one end is at the left corner and make a tally mark in the brown box. Then have them put down another stick so that one end touches the end of the first stick and make another mark in the box. Have them put down as many sticks as they can along the edge of the picture and make a mark for each stick. Then ask them to count the tally marks and make a ring around the brown numeral that shows how many marks they made.

2 Adapt Note 1 for each picture on the page.



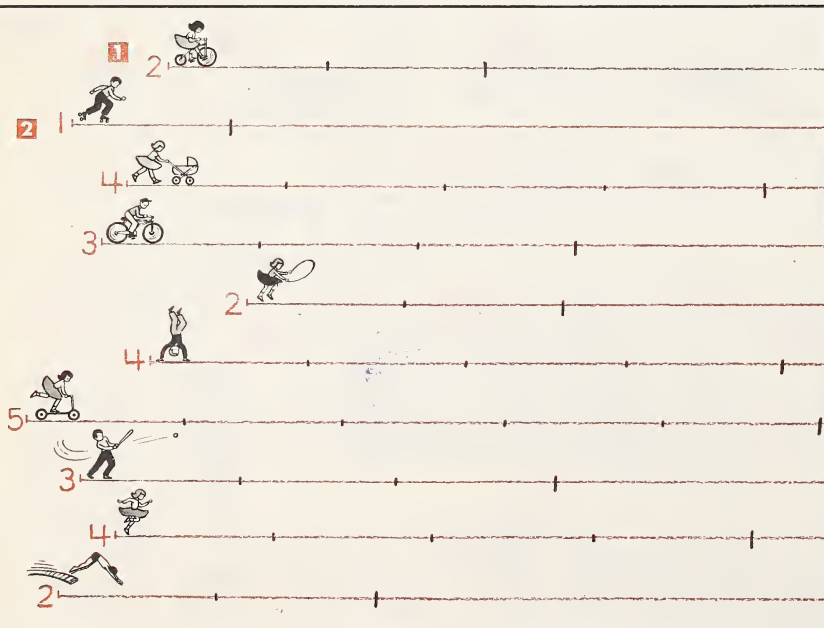
# 35



1 Give each child 1 two-inch stick. Ask the children to place the stick along the brown line in the first picture so that one end touches the mark at the beginning of the line. Then ask them to make a little mark at the other end of the stick. Next, ask them to put the stick down again so that one end touches the mark they just made and make another mark at the other end of the stick. Have them do this as many times as they can until they come to the end of the brown line. Then tell them to count the number of times they put the stick down, and make a ring around the right numeral at the top of the picture.

2 The above procedure should be repeated for the other pictures on the page.

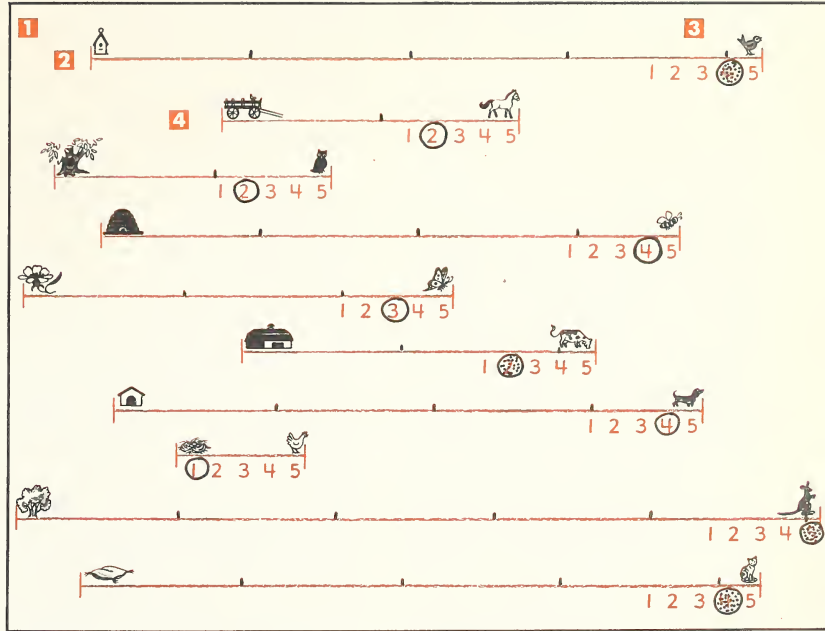
# 36



1 Give each child a two-inch stick. Direct attention to the brown numeral 2 beside the top line. Explain that this numeral means that the stick is to be put down on the line twice. Tell the children to lay the stick along the line so that one end touches the mark at the beginning of the line and then make a little mark at the other end of the stick. Tell them to pick up the stick and put it down again so that one end touches the mark they made. They should then make a larger mark at the other end. Say that this second mark shows where the little girl would be if she rode the length of two sticks along the line.

2 Tell the children to follow the same procedure for each exercise on the page. The brown numeral at the beginning of the line tells them how many lengths of the stick they are to measure.

- 1 Give each child 1 two-inch stick.
- 2 Tell the children they are to measure to find how far the bird flew. Have them place the stick so that one end touches the mark at the beginning of the line and make a mark at the other end. Then tell them to put the stick down again so that one end touches this mark and to make a mark at the other end. Tell them to do this as many times as they can until the stick almost touches the brown mark.
- 3 Tell the children to make a ring around the numeral that tells how many times they put the stick down. Explain that the ring should be filled in if the distance is more than is shown by the numeral. It should remain as it is if the distance is less than is shown by the numeral.
- 4 Have the children follow the same procedure for each exercise.



## 38-41 POSITIONAL MEANINGS OF 1 TO 10

### Objectives

Positional meanings, which the child has learned for the numbers 1 to 5, are now introduced for the numbers 6 to 10. He must learn the sequence 6, 7, 8, 9, 10 as it indicates position in a series, and he must learn the positional relationships among these numbers and their relationships to numbers with corresponding positions in the 1 to 5 sequence. He must learn to identify, without counting, 6 and 10 as the beginning and end of the sequence and that these positions correspond to 1 and 5 in the first part of the series; 8 as the middle of the sequence and that it corresponds to 3. He must learn that 7 follows 6 and precedes 8, that 9 follows 8 and precedes 10, and that 7 and 9 correspond to 2 and 4. He must learn

that these positions do not vary, although the series may be counted off from left to right, right to left, top to bottom, or bottom to top. He also learns to recognize the number symbols from 6 to 10.

### Preliminary Teaching

Before doing the exercises on Worksheets 38-41, the children should learn to count off a series of objects from 1 to 10, starting from the left and from the right. They should also learn to recognize the number symbols 6 to 10.

First, review the positional meanings of 1 to 5. Any of the activities suggested in the Preliminary Teaching for Worksheets 15-18 (pages 18-19) can be used for this purpose. When you are sure the children know the series

1 to 5, introduce the numbers 6 to 10 by counting off aloud the series 1 to 10. Do not use the number symbols at this point. Place 10 objects (such as books) in a row, one by one, counting off as you do so. Make 10 marks on the chalkboard, counting them off as you make them. Be sure always to divide the series into two distinct groups by leaving more space between the fifth and sixth objects (or marks) than between the others. Go through these procedures, alternating between left and right as the starting point.

Next, using the same row of 10 objects or marks, develop the positional meanings of 6 to 10. (The activities suggested in the Preliminary Teaching for Worksheets 15-18 may also be used.) Start by establishing 6 and 10 as the end positions in the second group of the series and 8 as the middle position, then 7 as follow-

ing 6 and preceding 8, and 9 as following 8 and preceding 10.

Begin somewhat as follows: "Let's start from this side [point to the children's left]. Can you tell just by looking how many books are in the first group? Then can you tell just by looking how many are in the second group? If there are five books in the first group, what is the number of this book? [Point to the first book in the second group.] What is the number of this book? [Point to the last book in the group.] Now if we start from this side, which book will be number 6? [Point to the children's right.] Which book will be number 10? What is the number of the book in the first group [starting from the right] that is in the same position in that group as book number 6 in the second group? What is the number of the book in the first group that is in the same position as book number 10 in the second group? What is the number of this book? [Point to book number 8.] What is the number of the book that is in the same position in the first group? Now let's start from this side again. [Point to the children's left.] Which book will be number 3? Which book will be number 8? How do you know? [Try to get the children to say that each is the middle book in its group.] Find book number 2. Now what is the number of this book? [7] How is its position like the position of book number 2?" [Try to get the children to say that it always follows the first book in the group and comes before the middle book.]

Vary the activities with situations in which the children can arrange themselves in a series according to directions given by you or by other members of the group. For example, put a row of 10 chairs, arranged in two groups of 5, in the front of the room. Say: "Mary, sit in chair number

3 starting from this end. Jim, sit in this chair. [Point to chair 10.] What is the number of the chair you are sitting on?"

Next, introduce the number symbols 6 to 10. The activities suggested for the introduction of the number symbols 1 to 5 (see pages 18-19) can be adapted for use here.

[Worksheets 38, 39, and 40 can be used at this point.]

When the children know the positional meanings of the numbers 1 to 10 and can recognize the number symbols 1 to 10, teach them the meaning of the words *left* and *right*, *front* and *back*, *top* and *bottom*, and *near* and *far*. Before beginning the work on Worksheets 38-41, they should become familiar with the terms *first*, *second*, *third*, *fourth*, and *fifth*. Do not overstress these words, but use them naturally whenever possible. Encourage the children to use these terms.

It will probably be necessary to concentrate on the meaning of *left* and *right* in most of the activities. Start by asking the children to put up their right hands. Point out that *left* is always opposite to *right*. If there are no left-handed children in the group, the meaning of *right* can be introduced by a discussion of which hand is used for various familiar actions, such as holding a fork or spoon, writing, turning the page of a book, or throwing a ball. If there are left-handed children in the group, such a discussion should be postponed until the children are able to distinguish between *left* and *right*. Great care must be taken to point out that some people naturally use the right hand and some the left, and that such use is determined by comfort, not by rule. No left-handed child should be made to feel that he is doing anything incorrect in using his left hand. Marching games or "Simon Says" can be

used to give the children experience in the rapid selection of *left* and *right*.

Any of the activities used to develop the positional meanings of the numbers can be used here. Instead of saying "... starting from this side" say, "Start from the right" or "Third child from the left, change places with the fifth child from the left." Use the same type of exercise to give the children experience in counting off from the front to the back and from the back to the front. *Near* and *far* can be developed by giving such directions as "Carol, sit in a chair near the bookcase. Dick, sit in a chair far from the windows. Mary, put this book near the right side of the table." In developing the meanings of all these words, use activities in which the children count off or identify numbered positions as often as possible.

The amount of time devoted to preliminary teaching before Worksheets 38-41 are used should be about the same as that required for Worksheets 15-18. The provisions for individual differences will also be the same. Some additional time should be allowed for the work on the meaning of *left* and *right*, and *near* and *far*.

[Worksheet 41 can be used at this point.]

## 38 Comments

On this page the child reviews the positional meanings of the numbers 1 to 5. The positional meanings of the numbers 6 to 10 are introduced.

Introduce this page by giving the children some practice in recognizing the number symbols 1 to 10. Write the numerals on rather large cards, one numeral to a card. Let the children take turns arranging the cards in order at the chalkboard, starting from the left and from the right. Have other children take turns reading the

numerals aloud. Then point to the numerals in random order and have various children identify them. Fasten paper clips on the edge of a piece of oaktag and have the children arrange the numerals on the cards from top to bottom and from bottom to top.

After the children have done the exercises on page 38, let them discuss and correct their work.

## 39 Comments

On this page the child develops knowledge of the positional meanings of the numbers 6 to 10, and he practices locating positions in the series from 1 to 10 starting from either the left or the right. He also learns to use the words *left* and *right*.

The idea of left and right is sometimes confusing to children and should be made as simple as possible. In the beginning, always identify the position by both pointing and saying "left" or "right." Continue to identify left and right without making too great a point of it until the children are used to the terms and directions. Then, also without making an issue of it, ask them to start at the left or right of the page without pointing to it. Watch to see that the children find the correct side of the page. Help them to learn these directions gradually and comfortably. It should be pointed out to the children that some people are right-handed, that is, that it is easier for them to do many things with their right hands; and that some people are left-handed, and find it easier to do the same things with their left hands.

Introduce this page by setting up 10 cards, each with an identical, simple picture on it, in the chalk tray. One picture may be black, for example, and all the others in another color. Be sure to leave a space between the fifth and sixth pictures. Ask

the children what number the black picture is, starting from the left and starting from the right. Change the position of the black picture and ask the same questions. Repeat this procedure until the children respond quickly and correctly without help.

In each row of pictures on page 39, the children are to locate numerically four different positions, two starting from the right and two starting from the left. The abilities of the children should determine how the page is to be used. Some groups should be given the first set of instructions, be permitted to do that part of the work for the entire page, and then be given a second set of instructions for the entire page, etc. Some groups should be given the first two sets of instructions at the same time and permitted to locate the brown figure from the left first, then from the right for each row of pictures. No group should be given all four sets of directions at one time.

This page may be checked by using a tissue overlay.

## 40 Comments

On this page the child continues to locate positions in a series of 10, starting either from left or right.

The idea that numerical position within a series is always relative to a starting point is developed on this worksheet. The children are required to assign two sets of numbers to the same objects; one number they find by starting from the left and the other by starting from the right. In the first row the same numbers are used in both parts of the exercise so that the children see that the object to which 3, for example, is assigned starting from the left is not the same as the object to which 3 is assigned starting from the right. In the second row, 1 and 10 are assigned to the same

object, so that the children see that object 1 starting from the left is the same as object 10 starting from the right.

Introduce this page by asking the children to turn to page 38 and recall what they did there. Then have them look at the first row on page 40. Point out that it is different from page 38 in that none of the objects have numerals on them. Ask the children if they can see something else that is different about this page. Bring out the fact that there are numerals above the objects as well as below. Next explain what they are to do with the black numerals, and work through the first row with them. Then tell them what they are to do with the brown numerals, and work through the first row. The children should be able to finish the page independently.

With slow learners it would be advisable to have the children do the work in two parts. First, let them draw the lines from the black numerals to the proper objects in each row of pictures. Then have them draw the lines from the brown numerals to the proper objects in each row.

After the work has been completed, it should be discussed. Get the children to discover and point out the relationships. Let the children correct their own work during this discussion.

The vertical strip of pictures at the right of the page is to be used with page 41.

## 41 Comments

On this page the child learns to use two numbers to locate a position, working from bottom and left, top and left, and top and right. The ordinal words for position (first, second, etc.) are used.

The children have learned to count off a series of 10 objects starting

from left or right, and to locate numerically any position within such a series from either left or right. Now they learn that the same positions and relationships exist if they count off a series of 10 from top to bottom or bottom to top. They also learn to use two numbers to locate a position in a region that has two dimensions; a page is divided into horizontal rows that are counted from bottom to top or from top to bottom and are divided into boxes by vertical lines. These boxes are counted from right to left, left to right, top to bottom, and bottom to top. The children become familiar with the ordinal number words, which should be used verbally. Say: "Look at the third box in the first row," etc. If the children do not understand, explain by pointing to the box and saying "This is Row 1, Box 3."

Introduce the page by asking the children to look back at page 18 and recall what they did. Then have them turn back to page 41. Explain that in each of the four sections of that page there are five rows of five boxes each. Ask how many boxes are in one row of the two sections at the top of the page. Then ask how many rows there are on the whole page.

Reread the comments for page 18, as they apply to this page also. The pictures already in various boxes on page 41 are to help the children locate the rows and boxes. Since the rows and boxes are to be located from different starting points in different parts of this exercise, you should use these pictures to reorient the children each time they begin a new part of the page.

The strip of numbers and pictures at the right of page 40 is used with

this page. The children are to draw the objects shown in this key in the rows and boxes indicated by the numerals beside the objects. The first numeral gives the row, and the numeral in the square gives the box. For example, the top item of the black section of the key tells the children to draw a sun in Row 4, Box 6.

It will take several days for the children to complete the work on this page. Do not expect any group of children to copy the pictures exactly. Any drawing that is identifiable as the correct symbol is acceptable. The children should use a pencil of a different color for each part of the exercise.

This page can be checked by using a tissue overlay. This overlay will be more helpful if a different color is used for the pictures for each set of directions.

## 38

1 Direct attention to the top row of pictures. Tell the children that each box should have a numeral on it. Ask them to look at the numerals already on some of the boxes and decide in which direction they are numbered.

2 Direct attention to the brown numerals under the boxes. Tell the children to find a box that has no numeral on it, find the brown numeral that belongs on it, and draw a line from the numeral to the box. Tell them that in this way they are to put a numeral on each box that has no numeral.

3 Have the children follow the same procedure for each of the other rows of pictures on the page.

# 39

1 Direct attention to the row of dogs. Ask the children to find the brown dog and decide what number the dog is, starting from the left. Tell them to find the numeral among the black numerals at the left and draw a ring around it. Then have them decide which number the brown dog is, starting from the right, find the numeral among the brown numerals at the right, and draw a ring around it.

2 Point out that in the set of black numerals, one numeral has a square beside it. Have the children find the dog the numeral indicates, starting from the left, and put an X under it.

3 Point out that in the set of brown numerals one numeral has a mark next to it. Tell the children to find the dog the numeral indicates starting from the right, and put an X above it.

4 Ask the children to follow the same procedure for each picture.

|                             |                             |  |                                        |                                           |
|-----------------------------|-----------------------------|--|----------------------------------------|-------------------------------------------|
| 3<br>⑥<br>7<br>10<br>4<br>3 | 4<br>8<br>5<br>2<br>9<br>□  |  | 3<br>6<br>1<br>7<br>10<br>+<br>7<br>10 | 4<br>8<br>5<br>2<br>9<br>□                |
| 1<br>⑩<br>4<br>3            | 6<br>8<br>9<br>2<br>5<br>□  |  | 6<br>8<br>9<br>2<br>5<br>+<br>7<br>10  | 10<br>7<br>4<br>3<br>□                    |
| 3<br>4<br>⑦<br>10<br>□      | 9<br>5<br>2<br>8<br>1<br>□  |  | 3<br>④<br>7<br>6<br>10<br>□            | 5<br>4<br>2<br>8<br>1<br>+<br>7<br>10     |
| 7<br>2<br>4<br>1<br>9       | 10<br>6<br>8<br>③<br>5<br>□ |  | 7<br>2<br>4<br>+<br>1<br>9             | 10<br>6<br>8<br>3<br>5<br>□               |
| 6<br>1<br>8<br>10<br>4<br>□ | 3<br>⑨<br>7<br>5<br>□       |  | 6<br>1<br>8<br>10<br>4<br>+<br>8<br>10 | 3<br>9<br>2<br>7<br>5<br>□                |
| 6<br>8<br>10<br>⑤<br>3<br>□ | 2<br>4<br>7<br>1<br>9<br>□  |  | 1<br>10<br>4<br>2<br>9<br>□            | 8<br>6<br>5<br>3<br>7<br>+<br>5<br>3<br>7 |

# 40

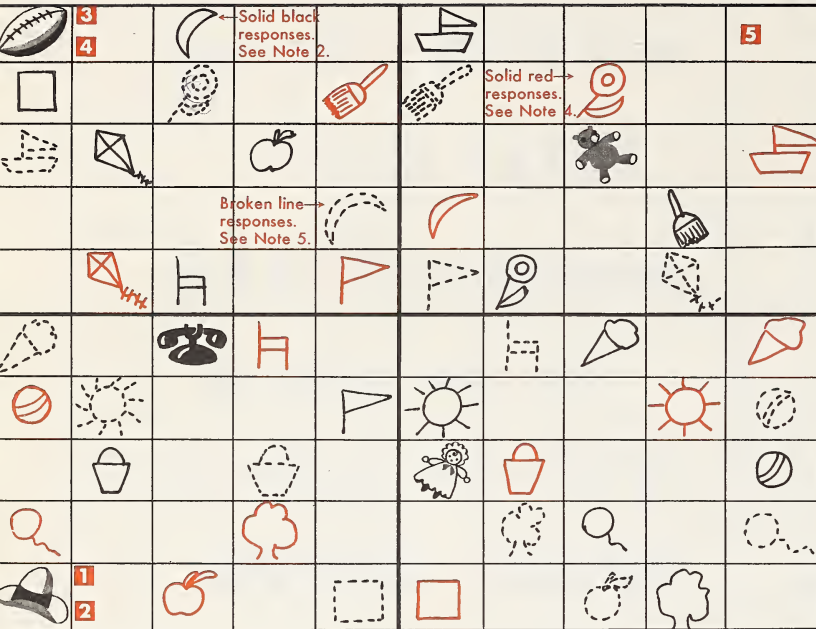
1 Explain that the strip of pictures and numerals at the right side of the page will be used later with another page. Direct attention to the top row of pictures. Tell the children to draw a line from each black numeral above the circus wagons to the correct wagon, starting the numbering from the left.

2 Tell the children to draw a line from each brown numeral under the wagons to the correct wagon, starting the numbering from the right.

3 Use Notes 1 and 2 for each row of pictures.

4 Discuss the finished work with the children.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |                                                                                                                                                                                                                                                                                                                                            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1<br>③<br>2<br>④<br>3<br>⑤<br>4<br>⑥<br>5<br>⑦<br>6<br>⑧<br>7<br>⑨<br>8<br>⑩<br>9<br>⑪<br>10<br>⑫<br>11<br>⑬<br>12<br>⑭<br>13<br>⑮<br>14<br>⑯<br>15<br>⑰<br>16<br>⑱<br>17<br>⑲<br>18<br>⑳<br>19<br>㉑<br>20<br>㉒<br>21<br>㉓<br>22<br>㉔<br>23<br>㉕<br>24<br>㉖<br>25<br>㉗<br>26<br>㉘<br>27<br>㉙<br>28<br>㉚<br>29<br>㉛<br>30<br>㉜<br>31<br>㉝<br>32<br>㉞<br>33<br>㉟<br>34<br>㊱<br>35<br>㊲<br>36<br>㊳<br>37<br>㊴<br>38<br>㊵<br>39<br>㊶<br>40<br>㊷<br>41<br>㊸<br>42<br>㊹<br>43<br>㊺<br>44<br>㊻<br>45<br>㊼<br>46<br>㊽<br>47<br>㊾<br>48<br>㊿ |  | 4<br>6<br>8<br>6<br>3<br>10<br>2<br>8<br>7<br>9<br>10<br>6<br>9<br>1<br>5<br>8<br>4<br>3<br>2<br>1<br>9<br>10<br>3<br>4<br>5<br>6<br>7<br>8<br>9<br>10<br>11<br>12<br>13<br>14<br>15<br>16<br>17<br>18<br>19<br>20<br>21<br>22<br>23<br>24<br>25<br>26<br>27<br>28<br>29<br>30<br>31<br>32<br>33<br>34<br>35<br>36<br>37<br>38<br>39<br>40 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



1 Have the children identify from the bottom and left the rows and boxes in which the large pictures are located. [The hat is in Row 1, Box 1.]

2 Refer the children to the column of black numerals and pictures in the vertical strip on page 40. Tell them that the first line tells them to draw a picture of the sun in Row 4, Box 6. Have them draw all the pictures in this column in the correct boxes, starting at the bottom and left.

3 Have the children identify from the top and left the rows and boxes in which the large pictures are located. [The football is in Row 1, Box 1.]

4 Ask the children to draw the pictures for the brown column on page 40 in the correct boxes, starting from the top and left.

5 Have the children draw the pictures for the brown column in boxes located from the top and right.

## 42-44 REVIEW

### Objectives

Worksheets 42-44 give the teacher a means of evaluating the children's understanding of three of the four fundamental arithmetic ideas with which they have been working. These ideas are: concepts of size, one-to-one correspondence, and recognition of groups of 3 to 10. The fourth idea, positional meanings of numbers, was handled in the preceding section.

### Preliminary Teaching

Since the purpose of Worksheets 42-44 is to find out whether the children understand and can use the ideas to which they have been introduced in the early pages of this book, no preliminary teaching is necessary for this section. After the exercises on all three worksheets have been com-

pleted, you will be able to judge whether or not the children need additional practice. If any weaknesses appear, they will probably be in recognition of groups, since concepts of size are a constant part of the children's daily experience, and one-to-one correspondence is a rather simple and primitive idea. Failure in group recognition would cause the most serious difficulties later on, when the children must use their knowledge of groups in learning the addition and subtraction basic facts, and even later, when they begin to work with multiplication and division. For these reasons, it is important that any weaknesses in group recognition be remedied before the children go on to the next unit. The activities suggested in the preliminary teaching notes for pages 11 to 14 and 20 to 32 can be adapted for this purpose.

## 42 Comments

On this page the children review relative size and length.

Introduce the page by lining up four or five objects of different sizes in the tray of the chalkboard. Over each draw a square. Ask the children to point out the biggest object, the smallest, and any that are the same size. Ask them which mark they would make in each square for the biggest and smallest objects and make these marks. Then draw a line connecting the objects that are the same size.

Have the children open their books. Work through the first picture with them. They should do the rest of the work on the page independently. Tell the children that in some pictures they may find more than one tallest, shortest, or smallest object. When they do, they are to put the correct mark in

each box and also draw a line connecting the objects to show they are equal in size.

A tissue overlay may be used to check this page.

### 43 Comments

On this page the children review one-to-one correspondence.

In this exercise the children match one set of objects with another set of objects and evaluate the results as *enough*, *not enough*, or *more than enough*. They may do the matching by using markers or by drawing lines from the children to the toys.

Introduce the page by making the three marks (●, ○, =) on the board and reviewing the meanings of *more than enough*, *not enough*, and *just enough*. Have the children open their books. Remind them briefly of the

previous pages in which they matched toys or objects to children. Explain that they are to make either the mark for *enough*, *not enough*, or *more than enough* in each brown square. Work through the first picture with them, and let them finish the page independently.

A tissue overlay may be used to check this page.

### 44 Comments

On this page the children review groups of 3 to 10.

The children are asked to recognize groups of 3 to 10, and to identify each group by selecting the correct numeral in each picture and encircling it. They review both group recognition and recognition of numerals.

Introduce the page by reviewing recognition of groups of 3 to 10 and

the number symbols 3 to 10. For this review use pictures on cards, pictures on the board, or actual objects for group recognition, and cards with numerals on them, markers with numerals on them, or numerals written on the board for recognition by the children.

Be sure the children are identifying the groups on the page visually, rather than by counting. They must also be able to recognize the numerals, since they are in random order.

A tissue overlay may be used to check this page.

## 42

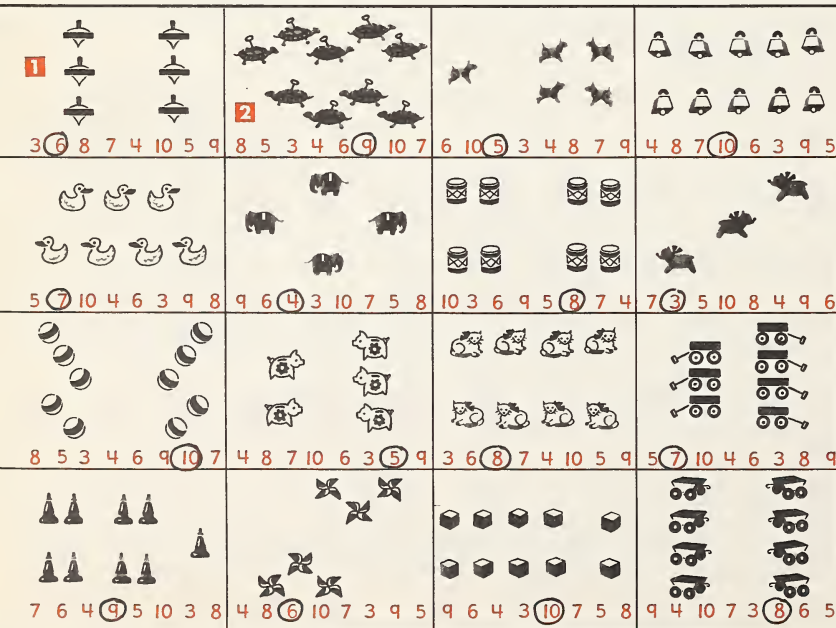
- Make the symbols ● and ○ on the board, and remind the children that ● means *biggest*, *tallest*, or *longest*, and ○ means *smallest* or *shortest*.
- Direct attention to the picture of the wagons. Ask the children to decide which is the smallest and put the correct mark in the brown square next to it. Then ask them to decide which is the largest and put the correct mark in the square next to it. Then ask them to decide if any of the wagons are the same size and, if so, draw a line connecting them. Examine their work to see that they understand and are responding correctly.
- Ask the children to follow the same procedure for the other pictures. Remind them to put a mark in each box if there is more than one tallest or shortest object.

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1 Let the children examine the page. Tell them they are going to find out if there are enough, not enough, or more than enough toys in each picture for each child in the picture to have one. Direct attention to the first picture. Tell the children to draw a line from each child to a scooter. [Markers may be used, if you wish.] Ask them to decide whether there is one for each child, too few, or more than enough scooters for the children. When they have decided, they are to put the mark = in the brown square if there is a scooter for each child, ● if there are more scooters than children, and ○ if there are fewer scooters than children. Examine their work to be sure they understand and are responding correctly.

2 Have the children follow the same procedure for each picture.



1 Let the children examine and discuss the page for a moment. Then direct attention to the first picture. Ask the children to look at it, decide how many tops there are, then find that numeral among the brown numerals below the tops and encircle it. Examine their work to see that they understand and are responding correctly.

2 Ask the children to encircle the proper numerals for the other pictures on the page.

## 45-49 TWO-TO-ONE CORRESPONDENCE; RECOGNIZING GROUPS OF 6, 8, AND 10

### Objectives

The idea of as many as or enough was established by having the child match one group of objects to another group of objects, thus making a one-to-one correspondence. Now, on Worksheet 45, he learns to match two objects to one object, or to make a two-to-one correspondence. On Worksheets 46-49 the even numbers 6, 8, and 10 are developed as being built up by 2's and are rearranged as 4,2; 6,2; 4,4; 8,2; etc. These two steps give the child not only a thorough understanding of the numbers 6, 8, and 10 and, by extension, of all even numbers, but also prepare him for the related addition, subtraction, multiplication, and division facts.

### Preliminary Teaching

Before using Worksheets 45-49, the children must have some experience in matching two objects to one object, in counting by 2's to 10, in building up 6, 8, and 10 from groups of 2, and in rearranging 6, 8, and 10 into subgroups of 2 and multiples of 2 (4, 6, 8).

A variety of activities in which two objects are matched with one object can be planned with very simple materials. For example, give each child 2 to 5 paper cups or plastic containers. Paper baking cups, plain nut cups, or boxes made by the children can be used. Do not give each child the same number of containers. Have on hand a pile of small objects such as stones, jacks, or sticks, and tell the children to take from the pile enough objects so that they will have 2 for each cup. Then have them put 2 of the objects into each cup.

Another way of using the same materials is to give each child 5 cups and 10 objects. Let the children take turns telling the rest of the group how

many cups they are going to put objects into. Direct them to count aloud by 2's as they put the objects into the cups. They should finish by telling how many objects they have in all and the number of cups.

Then let the children take turns distributing books, pencils, or pieces of paper to 5, or fewer, members of the group by 2's. Say: "Johnny, take enough pencils to give 2 to Mary, 2 to Frank, 2 to Sue, and 2 to Nancy. Now give 2 pencils to each of those children to be sure you took the right number. Marcia, take just enough paper to give 2 sheets to each of the children at your table. Did you take the right number of sheets of paper?" Vary this activity by having some children take just enough books or other such objects to give one to every two children.

[Worksheet 45 can be used at this point.]

Next, give the children 6 markers apiece. Ask each child to put down 2 markers, then to put down another group of 2 markers near it, and then to put down a third group of 2 markers. Have them count the markers by 2's as they put them down. Be sure they observe the groups as they put them down and count them. Have them spend some time rearranging the markers as 2,2,2; 4,2; and 2,4; each time counting them by 2's. Have them continue until they can see 6 as 2,2,2; 4,2; and 2,4.

[Worksheet 46 can be used at this point.]

Give each child 8 markers. Using the same type of activity suggested for Worksheet 46, have them arrange the markers in groups of 2, count them by 2's, and rearrange 8 as 6,2; 4,4; and 2,6. These activities can be made more interesting for the children by varying the markers. It

is important that the children learn to see the groups, and every effort should be made to make sure they are not counting the markers.

[Worksheet 47 can be used at this point.]

Give each child 10 markers. Have the children arrange their markers as 2,2,2,2,2; 8,2; 2,8; 6,4; and 4,6. Give them many opportunities to count by 2's to 10, using the same type of activity suggested for Worksheets 45, 46, and 47. Be sure they work with the markers until they are able to see the groups, and that they use only groups of 2 and multiples of 2.

[Worksheets 48 and 49 can be used at this point.]

## 45 Comments

On this page the children learn to match two objects to one object, or to make a two-to-one correspondence.

Matching two objects to one object to make a two-to-one correspondence serves several purposes. First, it extends the idea of as many as, or one-to-one correspondence, to two for every one, which, in time, the children will come to understand as twice as many. It is also a development of the idea of grouping things by 2's that is fundamental to all even numbers, each of which can be made by adding a group of 2 to the preceding smaller even number. Finally, in the most primitive way, two-to-one correspondence begins the child's preparation for the ideas of rate and ratio.

The children may either use markers with this page or draw lines, whichever is more comfortable for them. If they use markers, each child will need 10. The markers should be

placed on the objects in the white part of each picture, then two of them moved to each object in the brown part of the picture. The objects in the brown part of the picture all represent suitable containers for the objects in the white part.

Introduce the page by asking the children if they can think of any toys or things at home that require two things to go with one thing. Help them by suggesting 2 oars for a row-boat, 2 wheels for a bike, etc.

Ask the children to open their books to page 45, and let them discuss the pictures. Explain that each object in the brown part of a picture can hold 2 of the objects in the white part of a picture. They are to match 2 objects in the white part of each picture to each object in the upper part of the picture. Then they are to evaluate the results as *enough*, *not enough*, or *too many*. They are to write one of the usual response marks, ● for too many, ○ for not enough, and = for just enough, in the brown square in the lower right corner of each picture.

A tissue overlay may be used to check this page.

## 46 Comments

On this page the child learns to recognize 6 as composed of the subgroups 2,2,2, and 4,2.

Here and on the following worksheets, the even numbers 6, 8, and 10 are developed as built up by 2's and then rearranged as 4,2; 6,2; 4,4; 8,2; etc. These two steps give the children a more thorough understanding of the numbers 6, 8, and 10 and, by extension, of all even numbers, and help prepare them for the related addition, subtraction, multiplication, and division facts.

Introduce the page by reviewing the even subgroups of 6 (2,2,2; 4,2)

and also 3,3 because some of the children will suggest them although they are not even. Have the children draw simple pictures on the board to show these groupings, or let them arrange objects on a table or desk. Be sure these pictures and groupings are not in evidence when they begin the work in the book.

This page will present no difficulties for a very able or average group. Slow learners may need to use markers with the first few pictures on the page, but they should be able to do at least a part of the work independently.

A tissue overlay may be used to check this page.

## 47 Comments

On this page the child learns to recognize 8 as composed of the subgroups 2,2,2,2; 6,2; 4,4; and 4,2,2.

The first part of the comments for page 46 apply to this page also, and the directions for that page can be adapted for use here. The brown strip at the right of the page is to be used with page 49.

Introduce the page by having the children recall what they did on page 46. Tell them that page 47 is similar to page 46, and ask them to tell what groups make up a group of 8. If necessary, draw pictures of the subgroups of 8 or show them with markers.

A tissue overlay may be used to check this page.

## 48 Comments

On this page the child learns to recognize 10 as composed of the subgroups 2,2,2,2,2; 8,2; and 4,6.

The first part of the comments for page 46 apply to this page also. The directions can be adapted for use here.

Introduce this page by reminding the children of what they did on the previous two pages and reviewing the subgroups of 10 mentioned above.

A tissue overlay may be used to check this page.

## 49 Comments

On this page the child gets further experience in recognizing 6, 8, and 10 by seeing these groups in subgroups of 2 and multiples of 2.

Introduce the page by having the children use markers to show groups of 6, 8, and 10. Write these three numerals on the board, and be sure that all the children can recognize them.

The technique for using the brown strip on page 47 with this page is the same as that described in the "Comments" for Worksheet 7 (see pages 6-7 of this Teaching Guide).

When the brown strip is in position, the children are to look at a brown picture and the white picture next to it, decide how many animals there are in the two pictures, and circle the correct numeral in the white picture. An able group should do the work on the page independently after being shown what to do with a picture or two. It will probably be necessary to work through the entire first strip of pictures with an average group.

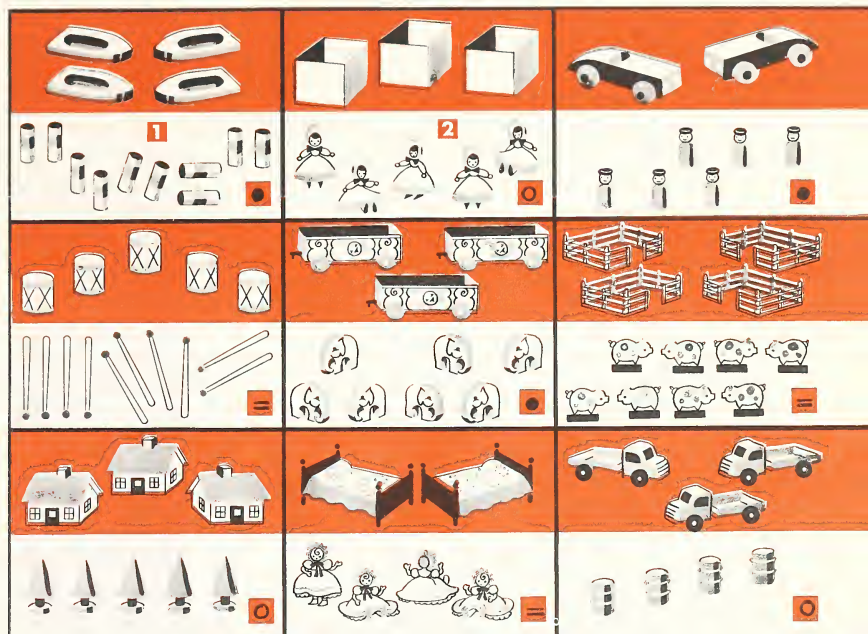
The work should be divided into two parts for a less able group. First have them go over the whole page looking for and marking groups of 6. Then let them look for groups of 8 and 10.

A tissue overlay may be used to check this page.

# 45

1 Point out that each picture is divided into a white part and a brown part. Two of the objects in the white part are to be placed into or next to a container in the brown part. Give each child 10 markers, and direct attention to the first picture. Have the children put a marker on each peg, then move 2 markers to each boat. They are to decide whether there are *just enough* pegs to put 2 in each boat, *not enough* for 2 in each boat, or *too many*. If there are too many, they are to put the mark ● in the square; if there are not enough, they are to put the mark ○ in the square; if there are just enough, they are to put the mark = in the square. If they prefer, the children may draw lines from the objects to the containers instead of using markers.

2 Have the children follow the same procedure for each picture.



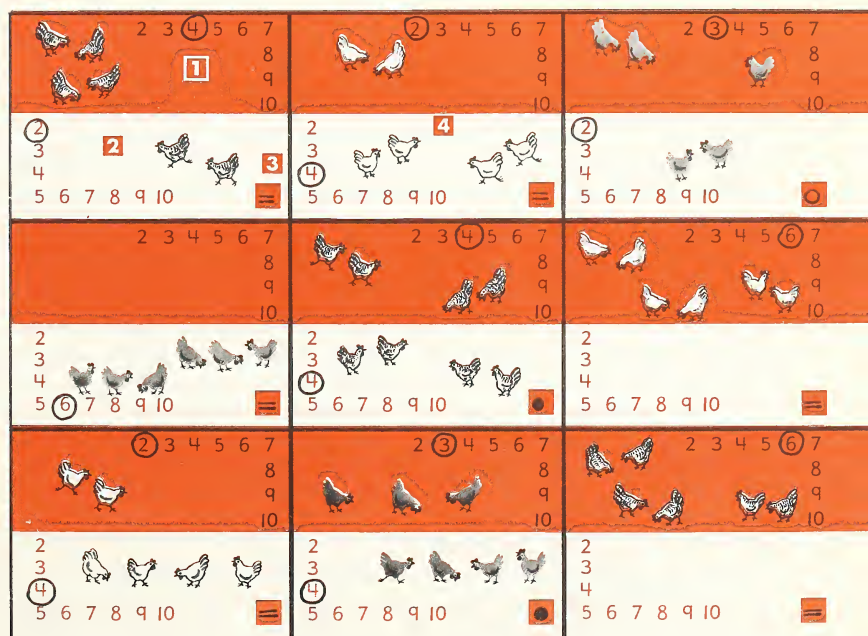
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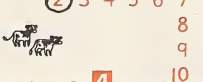
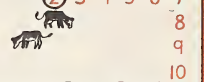
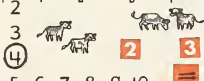
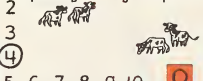
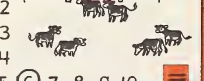
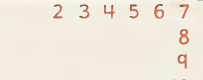
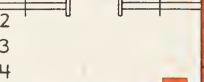
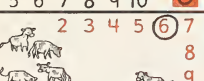
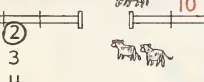
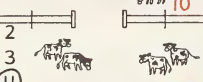
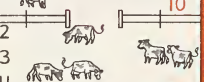
1 Point out that each picture on the page is divided into a white part and a brown part. Direct attention to the first picture. Ask the children to look at the brown part and decide quickly, without counting, how many chickens there are, then to find the numeral among the black numerals and draw a circle around it.

2 Ask the children to look at the white part, decide how many chickens there are, then to find the numeral among the brown numerals and draw a circle around it.

3 If there are 6 chickens in all in the picture, the children should make the mark = in the brown square. If there are more than 6, they should make the mark ●, and if there are fewer than 6 in all, they should make the mark ○.

4 Have the children follow the same procedure for the other pictures.



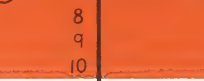
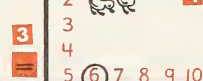
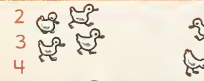
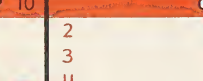
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| <br>2<br>③<br>④<br>5 6 7 8 9 10<br>② | <br>2<br>③<br>④<br>5 6 7 8 9 10<br>④ | <br>2<br>③<br>④<br>5 ⑥ 7 8 9 10<br>② |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <br>2 3 ④ 5 6 7<br>8<br>9<br>10<br>② | <br>2 3 4 5 6 7<br>8<br>9<br>10<br>② | <br>2 3 4 5 6 7<br>8<br>9<br>10<br>② |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <br>②<br>3<br>4<br>5 6 7 8 9 10<br>④ | <br>2<br>③<br>④<br>5 6 7 ⑧ 9 10<br>② | <br>2<br>③<br>④<br>5 6 7 8 9 10<br>② |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <br>2 3 4 5 ⑥ 7<br>8<br>9<br>10<br>② | <br>2 3 ④ 5 6 7<br>8<br>9<br>10<br>④ | <br>2 3 ④ 5 6 7<br>8<br>9<br>10<br>② |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <br>②<br>3<br>4<br>5 6 7 8 9 10<br>② | <br>2<br>③<br>④<br>5 6 7 8 9 10<br>② | <br>2<br>③<br>④<br>⑤ 6 7 8 9 10<br>② |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

1 Tell the class that the brown strip at the right of the page is to be used later. Then direct attention to the first picture. Ask the children to decide how many cows there are in the field at the top, then to find the numeral among the brown numerals and draw a circle around it.

2 Ask the children to decide how many cows there are in the bottom field, then to find the numeral among the black numerals and make a circle around it.

3 Now the children are to make the mark = in the brown square if there are 8 cows in all in the picture. If there are more than 8, they should make the mark ●. If there are fewer than 8, they should make the mark ○ in the square.

4 Ask the children to follow the same procedure for each picture.

|                                                                                                                        |                                                                                                                         |                                                                                                                         |
|------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| <br>① 2 3 4 5 6 7<br>8<br>9<br>10      | <br>2 3 ④ 5 6 7<br>8<br>9<br>10        | <br>2 3 4 5 6 7<br>8<br>9<br>10        |
| <br>2<br>③<br>④<br>5 6 7 ⑧ 9 10<br>② | <br>2<br>③<br>④<br>5 ⑥ 7 8 9 10<br>② | <br>2<br>③<br>④<br>5 6 7 8 9 ⑩<br>②  |
| <br>2 3 ④ 5 6 7<br>8<br>9<br>10<br>② | <br>2 3 4 5 ⑥ 7<br>8<br>9<br>10<br>② | <br>2 3 4 5 ⑥ 7<br>8<br>9<br>10<br>② |
| <br>②<br>3<br>4<br>5 6 7 ⑧ 9 10<br>② | <br>2<br>③<br>④<br>5 6 7 8 9 10<br>② | <br>②<br>3<br>4<br>5 6 7 8 9 10<br>② |
| <br>2 3 4 5 6 7<br>8<br>9<br>10<br>② | <br>2 3 4 5 6 7<br>8<br>9<br>10<br>② | <br>2 3 4 5 6 7<br>8<br>9<br>10<br>② |
| <br>②<br>3<br>4<br>5 6 7 8 9 10<br>② | <br>2<br>③<br>④<br>5 6 7 8 9 10<br>② | <br>②<br>3<br>4<br>5 6 7 8 9 10<br>② |

1 Direct attention to the first picture. Ask the children to decide how many ducks there are in the brown part of the picture, then find that numeral among the black numerals in the top part of the picture and draw a circle around it.

2 Ask the children to decide how many ducks there are in the white part of the picture, then find that numeral among the brown numerals and make a circle around it.

3 Now tell the children to decide whether there are just 10 ducks in all in the picture. If there are 10, they are to make the mark = in the brown response square. If there are more than 10, they are to make the mark ● in the square. If there are fewer than 10, they are to make the mark ○ in the square.

4 Have the children follow the same procedure for the other pictures.

- 1 Have the children place the brown strip from page 47 next to the solid brown line on page 49. Direct attention to the top pair of pictures. Tell the children to look at the hens in the brown picture and the hens in the white picture, then to decide how many there are in all in both pictures and circle the correct numeral in the white picture.
- 2 Ask the children to respond in the same way to the other pairs of pictures in the brown strip and the white strip.
- 3 Have the children follow the same procedure for the other four white strips on the page.

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| <br>6 8 10   | <br>6 8 10   | <br>6 8 10   | <br>6 8 10   | <br>2 6 8 10 |
| <br>6 8 10   | <br>6 8 10   | <br>6 8 10   | <br>6 8 10   | <br>6 8 10   |
| <br>6 8 10   | <br>6 8 10   | <br>6 8 10   | <br>6 8 10   | <br>6 8 10   |
| <br>6 8 10   | <br>6 8 10   | <br>6 8 10   | <br>6 8 10   | <br>6 8 10   |

## 50-54 MEASUREMENT OF CAPACITY

### Objectives

All types of measurement share a common set of principles. The most important of these principles is that there is a need for standard units. The idea of a standard unit in linear measurement was introduced and developed on Worksheets 33-37. Now the more difficult idea of standard units for the measurement of capacity is introduced. Before the child can be expected to understand conventional standards like *pint* and *quart*, he must learn that the measurement of capacity is determined not only by the shape of the containers used and the number of containers used, but by the size of the containers. He must have enough experience in estimating and comparing the capacity of containers of various sizes and shapes to de-

velop reasonable judgment about capacity. The same basic steps that were used to prepare the child for understanding linear measurement are used for the measurement of capacity. First he uses a single measuring model once for each quantity measured. Then he uses more than one copy of the model. He measures to find out if one quantity is more than or less than another quantity, and then he measures a given quantity of material by using one model repeatedly. Finally, he must learn to recognize situations in which he cannot tell whether or not one quantity is greater than another.

### Preliminary Teaching

Before using Worksheets 50-54, the child must recognize the need for a

standard unit in the measurement of capacity and learn to use such a unit to measure a given quantity. He must also learn to make approximate judgments of quantity when it is possible, and to recognize situations in which it is not possible for him to judge or compare quantity.

Two kinds of materials are needed for the activities suggested below to precede the use of Worksheets 50-54: substances to be measured and containers with which to measure them. The most convenient substances to measure are rice, dried peas, beans, and corn. Liquids and sand are apt to be troublesome in the classroom and should be avoided. Small wooden beads can be used if a sufficient quantity is available. There should be a variety of containers of different shapes and sizes. Some should be equal in capacity but different in

shape, some should be alike in shape and capacity, and some should be unlike in shape and capacity. Pint and quart milk bottles, fruit and pickle jars, berry baskets, pitchers, and boxes are all suitable.

Start by discussing with the children how different kinds of food are bought. For example, some things are bought by the dozen, some by the package, some by the pound, and some by the pint or quart. Point out to them that packages come in standard sizes—that every package in a grocery store is not a different shape and size, but many foods come in two or three different sizes. Do not attempt to explain to the children what a pound or a pint or a quart is, but be sure they understand that people buy things by the pound or by the quart so that they will know how much of something they are getting. Lead the discussion to things that are measured by bulk, and ask them how they know that each time they buy a quart of milk they get the same amount of milk. When they say that the bottles are all the same size, ask them if the bottles are always full, and if they could be sure that each bottle had the same amount if the bottles were not full. Then ask if they have ever seen both cartons of milk and bottles of milk in the same store, and how we can be sure that they hold the same amount of milk. Show them an empty milk carton and an empty milk bottle. Ask if there is any way to find out if the containers will hold the same amount. Fill one of the containers with rice or dried beans. Get the children to suggest pouring the contents of one container into the other. If possible, have two or three other containers of different sizes. Taking each in turn, ask the children if they think it will hold the same amount as the milk carton. Then let them find out whether the containers

hold more or less or the same amount by pouring the contents of the filled carton into each of them.

Next, have on hand a number of containers that are equal in capacity. They may be pint bottles, berry baskets, or boxes of the same size and shape. First, fill the containers and divide them into two unequal groups. Ask the children which group of containers holds the greater amount. They should understand that three full boxes hold more than two full boxes, if the boxes are alike. Then vary the amounts in the boxes, and let the children guess which group holds the greater amount when all the boxes are not full. Let them test their judgment by redistributing the material in the boxes to fill as many boxes as possible in each group.

Partly fill two containers that are different in size and shape, and let the children guess which contains the greater amount. Let them measure by pouring the contents into smaller containers of equal size. Continue these activities until the children understand that they must consider the size and shape of the containers, the number of containers, and the quantity of material in each.

[Worksheets 50 and 51 can be used at this point.]

Next, the children should get some experience in using a single measuring unit over and over. Ask one of the children to pour a cupful or glassful of rice or dried peas into each of two containers of different size. Ask the other children if each holds the same amount, and how they know. Then say: "Put two more cups of rice into this jar. Now put three more into this jar. Do both jars still hold the same amount? Which holds more? How do you know?"

Fill two containers of different size and shape, and ask the children to guess which holds the greater amount.

Then let them use a smaller container to measure the amount in each. Be sure they fill the smaller container to the same level each time, and that they understand that if they do not the measurement will not be accurate. Ask them to guess how many cupfuls a container will hold, or which of two containers will hold more, and then let them use a cup measure to find out. Pour three cupfuls of beans into one jar and three glassfuls of beans into another, and ask the children if each jar has the same amount of beans in it. They should understand that the unit of measure as well as the number of times it is used must be the same for the jars to have the same amount of beans.

Continue with activities similar to those suggested above until you are sure the children see that quantity can be measured by using the same unit over and over and counting the number of times it is used if it is always filled to the same level. Make sure that each child in the class has an opportunity to do some measuring. Develop the idea that quantity is not determined by the shape of the container, but by the amount it holds.

[Worksheets 52, 53, and 54 can be used at this point.]

Several arithmetic periods should be devoted to the activities suggested above before using Worksheets 50-54. Be sure the children have a number of experiences in making and testing judgments about quantity and that these judgments are thoroughly discussed.

## 50 Comments

On this page the child decides whether the contents of one container are greater than, equal to, or less than the contents of another.

Introduce the page by placing a variety of containers on a table in

front of the room. Paper cups and cartons of various sizes, empty berry boxes, etc., are all suitable. None of the containers needs to be capable of holding liquid. Be sure no two containers are exactly alike, but have several of different shapes that will hold approximately the same amount. Let the children arrange the containers in a row so that the one they think will hold the most is at one end and the one they think will hold the least is at the other end. Let them verify their judgment by using beans or peas to determine the relative sizes of the containers. Give them a different assortment of containers and let them try again. Repeat this several times. Then have them open their books to page 50.

There are two containers in each picture on this page. The children are to judge whether there is more fruit in one container than the other, whether they hold the same amount, or whether it is impossible to tell. The three usual marks, and also the fourth mark, the scribble mark, meaning "cannot tell," are to be used.

When the children have completed the page, let them discuss their answers and give the reasons for them. Be especially careful to discuss thoroughly any pictures for which the children's answers differ. They should understand that they must consider the size and shape of both containers and the quantity of fruit in each in making their decisions.

## 51 Comments

On this page the child exercises judgment as to whether the contents of one group of containers are greater than, less than, or the same as the contents of another group.

Introduce this page by filling 7 containers of the same size and shape (7 paper cups) with some material

such as dried peas or beans. Arrange the containers in two rows—4 in one row and 3 in the other. Ask the children in which row there are more peas or beans. If necessary, direct their attention to the number of containers in each row. Vary this setup by putting the same number of containers in each row and leaving one empty, then by putting the same number of containers in each row and having one of them larger or smaller than the others. Each time a child tells in which row there are more peas or beans, have him tell why.

The procedure for Worksheet 51 is the same as that for Worksheet 50, except that the child compares the contents of several containers with the contents of several others.

Be sure the children understand that they must look at the number of containers in each row, the size and shape of each container, and the amount of berries in each when they are making their decisions. It is important to conclude the work with a discussion of the children's decisions.

## 52 Comments

On this page the child gets further experience in exercising judgment as to whether the contents of one group of containers are greater than, less than, or the same as the contents of another group of containers.

The procedure to be followed on this page is the same as that suggested for Worksheets 50 and 51. If you are working with a slow group, it may be necessary to work through some of the exercises, since there are more difficult situations on this page than on the two preceding pages.

## 53 Comments

On this page the child compares two quantities obtained by using each of

two containers a specified number of times.

The judgments the children must make to do the exercises on this page are the most difficult that have been required of them. First, they must judge the comparable capacities of the two containers, then they must consider the number of times each container is to be filled, and then they must compare the two quantities so obtained and decide whether one is greater than the other, or whether they cannot tell. Since the containers may be different in size or shape, or both, and since they may be filled a different number of times, each decision will require careful consideration. The children should be reminded that a small container filled many times might easily produce a greater quantity than a large container filled a few times; that if the two containers seem to be nearly the same size but are different in shape, it is impossible to be sure which one will hold more. Of course if one is filled more times than the other, the quantity used will be greater.

Introduce this page by drawing on the board four pictures similar to those in the book. In one, have two containers the same in shape, but different in size; in another, have containers the same height, but different in shape; in another, have containers the same size and shape; in the fourth, have containers that are different in shape and size. Tell the children to pretend that they are going to fill the containers with water and pour the water into a large pail. Point to the first container in the first picture and tell the children they are going to fill it three times. Have them count as you put three marks above the first container. Then tell them they are to imagine they fill the container next to it twice and pour the water into a pail. Again have them count

as you draw two lines above the second container. Ask them which container used more water, and be sure they give reasons for their answer. Repeat this procedure with the other pictures you have drawn on the board.

Have the children open their books to page 53. Explain that the exercises are the same as the ones they have just done on the board and that the brown lines above each container tell how many times they are to pretend to fill it. The response marks are the usual ones—● for more, ○ for less, = for equals, and ≡ if they cannot tell. Both response squares in each picture are to be used.

This page and Worksheet 54 both require very acute judgment. Very able and average groups will find them interesting and will enjoy making their decisions independently as

soon as they understand what to do and how they are to respond. Some of the less able children may not be able to do the work for these pages. If it is obvious that they are not capable of doing any of the work independently, work with them for at least one period, discussing thoroughly as many of the exercises as you can get through in that time.

## 54 Comments

On this page the children continue the comparison of quantities begun on the previous page.

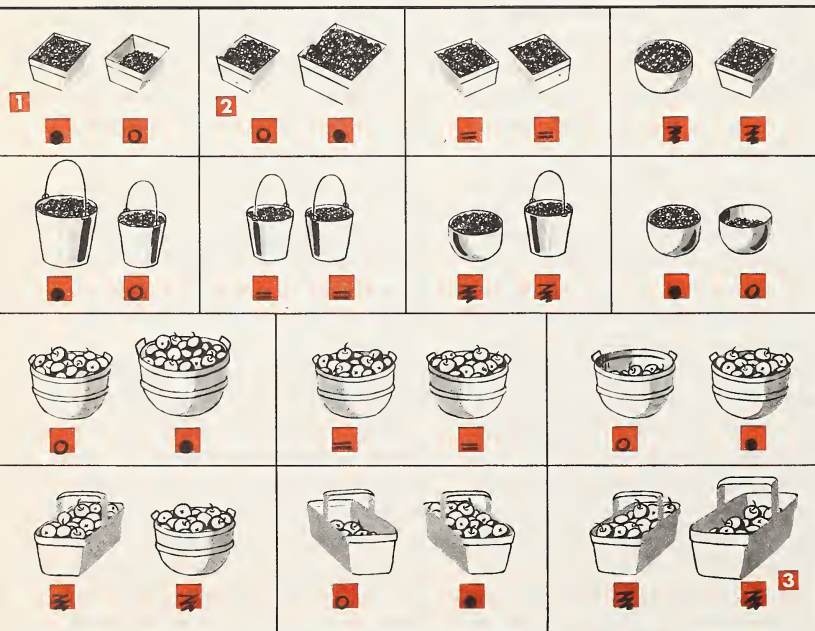
The objectives of this page and the techniques used for it are exactly the same as for the preceding page. The comments for Worksheet 53 apply to Worksheet 54. It is hoped that when the children finish the work on these two pages they will not only have

developed to some extent the ability to judge quantity, but also will realize that at times it is impossible to compare capacity except by actual, accurate measurement. Be sure that no child feels that there is anything incorrect in the "cannot tell" response in those cases where accurate judgment is not possible.

Introduce the page by telling the children that the work is exactly like that for the preceding page. Remind them that they must observe the marks above each container and the size and shape of each container.

If you are working with a very slow group, spend the period working through and discussing as many of the exercises as possible in the time available. In this instance, it is more important that they understand the principle than that they try to work independently.

# 50



1 Let the children examine the page. Then direct attention to the first picture. Tell the children that if they think there are more berries in one basket than the other, they are to put the mark ● in the square under the basket in which there are more berries and the mark ○ in the square under the basket in which there are fewer berries. If they think there is the same amount of berries in each basket, they are to put an equals sign in each square. If they cannot tell whether or not there are more berries in one basket than the other, they are to make a scribble mark in each square.

2 If the children respond correctly to the first picture, have them finish the page independently.

3 Let the children discuss their responses.

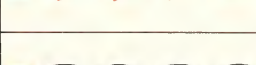
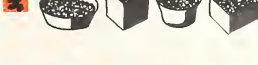
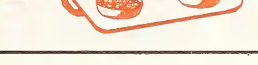
# 51

1 Direct attention to the first picture. Ask the children to look at the two rows of baskets of berries and decide whether there are more berries in one row than in the other, whether there is the same amount of berries in each row, or whether they cannot tell if there are more berries in one row than the other.

2 Remind them to put a mark in each brown square in the picture: ● in the square before the row in which there are more berries, ○ in the square before the row in which there are fewer berries, = in both squares if the rows have the same amount, and ≡ in both squares if they cannot tell.

3 Ask the children to use the same procedure for the other pictures on the page.

4 Let the children discuss their responses.

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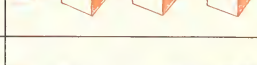
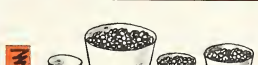
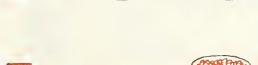
# 52

1 Direct attention to the first picture. Ask the children to decide whether there are more berries in one row of containers than the other, whether there is the same amount of berries in each row, or whether they are unable to tell if there are more berries in one row than the other row.

2 Tell them to put the response mark that shows what they decided in the brown square in front of each row. If necessary, remind them what these marks are. (See directions for Worksheets 50 and 51.)

3 Have the children follow the same procedure for the other pictures on the page.

4 Let the children discuss their responses, particularly those on which they disagree.

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## 55-61 COMPONENT GROUPS OF 6 AND 7

### Objectives

The component groups of a number are pairs of subgroups, each of which may be combined to make that number or into which that number can be separated. These pairs of subgroups are learned in the next grade as "basic facts." In this section the basic groups of 6 and 7 are presented and developed.

### Preliminary Teaching

Before using Worksheets 55-61, the children must be able to recognize groups of 6 and 7, to make them by joining pairs of groups, and to separate them into pairs of groups. There are three such sets of subgroups for the number 6 (3,3; 4,2; 5,1) and three for the number 7 (4,3; 5,2; 6,1). The children should learn to recognize these groups without counting.

First, using markers or X's on the board, review groups of 6 and 7 and the subgroups for these numbers that the children have already learned. Next, give each child three sets of markers, each set in a different color. Have 7 markers in each set. Ask the children to put one marker from each set aside to use later. Then ask them to arrange the three sets of markers in 3 groups on their desks, to look at them quickly, and to tell how many markers there are in each set. The children should all agree that there are 6 markers in each set. Now ask them to separate one of the sets into two groups. Then say: "Marie, how many markers are there in each of your two groups? How many red markers are there in all? Did anyone else in the class also separate his red markers into 2 groups of 3? Now separate the green markers into two groups. Make them different from the groups you divided the red markers into. Jack, how many markers are

there in each of your groups? Did anyone else in the class make a group of 5 and a group of 1? Separate the last set of markers into two groups. Be sure they are different from the groups you used the other two times. Who has divided them into groups that are not 3,3 or 5,1? What are your groups, John? How many other pupils divided the last set of markers into a group of 4 and a group of 2? Does everyone have a set of markers separated into 2 groups of 3? Does everyone have a set of markers separated into a group of 4 and a group of 2? Does everyone have a set separated into a group of 5 and a group of 1? How many markers in all are in each set?"

Tell the children to push the markers in each set back together and separate each set into 2 groups again. Ask them to find as many ways as they can to separate 6 into 2 groups. They should discover the three ways that this can be done.

Throw 6 markers on the table. Let the children take turns arranging them in two groups. Have the other children watch, and let them take turns telling what component groups of 6 are being shown. Give the children much practice with this work.

Finally, give the children considerable practice in seeing and recognizing component groups of 6 without counting or without arranging the objects manually. This can be done by using cards on which have been pasted small pictures of 6 objects arranged in various patterns of the three pairs of component groups, by arranging markers on a table, or by drawing X's on the board. After some practice in quick visual recognition of component groups of 6, throw small objects (jacks, for example) on a table in random groups of 4, 5,

and 6, and let the children take turns telling the number of objects in each group.

[Worksheets 55, 56, and 57 can be used at this point.]

Ask the children to put the single markers that were put aside earlier back into their three sets of markers. Review the subgroups for 7 that the children have already learned; then present the component groups of 7. These are 4,3; 6,1; and 5,2. Adapt the techniques suggested above for component groups of 6. Follow this by giving the children practice in recognizing the component groups of 7 without arranging the objects manually. Then review recognition of random groups of 4, 5, 6, and 7 and let the children take turns telling the number of objects in each group.

[Worksheets 58, 59, 60, and 61 can be used at this point.]

In presenting this material to the class, it would be well to spend part of an arithmetic period on preliminary teaching and the rest of it on one of the worksheets so that the children have a variety of experiences with the component groups of 6 and 7. With some children, however, it might be advisable to spend a whole period working with markers or X's before using Worksheet 55. After this introductory work and Worksheet 55 have been completed, some time should be spent in working with markers at the beginning of each class period before doing the exercises on Worksheets 56 and 57. When Worksheet 57 has been completed, devote a period to introducing the component groups of 7, using the techniques outlined above for component groups of 6. Then work with markers before doing the exercises on Worksheets 58-61. Include some work in recognition of groups of 4 and 5 when working with groups of 6, and of 4, 5, and 6 when working with groups of 7.

## 55 Comments

On this page the children learn to recognize the component groups of 6 as 3,3; 4,2; and 5,1.

On Worksheet 55 and the following 18 pages, the children return to the study of groups, which is the most important part of their work in arithmetic for the year. On these pages recognition and understanding of the component groups of 6, 7, 8, 9, and 10 are taught, and recognition of the groups from 3 to 10 is reviewed. The portion of these comments that does not specifically discuss Worksheet 55 and the techniques to be used with that page apply in general to Worksheets 55-73.

Some of the groups that make up the numbers to 10 have already been studied. The children have learned to recognize the model groups 2, 3, and 4 and to build up the numbers 5 to 10 by combining groups of 2, or groups of 2 and a single object. Now, in further preparation for the processes of addition and subtraction, the children learn the component groups of the numbers 6 to 10. Component groups are those pairs of subgroups into which these numbers can be separated, or those pairs of groups that can be combined to make these numbers. The component groups of 5 (3,2; 4,1) are the only ones that have already been studied. On pages 55, 56, and 57 the component groups of 6 (3,3; 4,2; 5,1) will be introduced and developed, and on subsequent pages the component groups of the other numbers to 10 will be studied.

Component groups are the pairs of groups that will be learned as the addition and subtraction basic facts in the second grade. Since learning the basic facts and understanding the processes of addition, subtraction, multiplication, and division are the foundation of skill in arithmetic, this

phase is clearly most important in the children's primary work. Spend as much time on these pages as is necessary to be sure the children really learn the component groups.

Introduce Worksheet 55 by asking the children if they have ever seen a circus, and let them describe some things that might be seen at a circus. Tell them that today they are going to look at some pictures of things that might be seen at a circus, and that they are to decide whether or not two pictures together show a group of 6. Review with them the two groups that make up 5 (3,2; 4,1), and show them how one more object makes a group of 6. Have them open their books to page 55. Let them look at all the pictures and identify the objects. Then continue as directed.

The technique for using the brown strip on Worksheet 53 with Worksheet 55 is the same as that described in the "Comments" for Worksheet 7 (pages 6-7 of this *Teaching Guide*).

If necessary, give each child 6 markers to use with the first column or two. With a particularly slow group, you may let the children use markers with all the pictures on the page.

A tissue overlay may be used to check this page.

## 56 Comments

On this page the children make a group of 6 by selecting a component group to combine with a key group.

The work on this page is the next step beyond passive recognition of groups. In each picture on page 56 there are two groups of objects, one printed in brown and one printed in black. The brown objects are the key group. The children are to select enough black objects in each picture to combine with the key group of objects to make a group of 6 in all. They combine the groups by drawing

a ring around them. Be sure they understand that if they choose black objects that are close together and close to the brown objects they can easily draw a ring around both groups.

Introduce the page by reviewing with the children the component groups of 6 (4,2; 3,3; 5,1). Have three children show the component groups of 6 by drawing X's on the board, and, if necessary, let all the children work briefly with markers at their desks. Have them open their books to page 56, and let them use markers on the first picture or two as you explain what they are to do. They should do the rest of the work on the page without markers.

There are several correct ways of forming each group of 6 on this page. You may check each child's worksheet, or you may let the children discuss and correct their own work.

## 57 Comments

On this page the children distinguish among the various pairs of component groups of 6.

These exercises are the third step in introducing the component groups of 6. On page 55 the children became acquainted with the component groups of 6, on page 56 they selected and combined a group of objects with a key group to make a group of 6 in all, and on this page they distinguish among the various pairs of component groups of 6.

Introduce the page by drawing simple pictures on the board to show the three pairs of component groups of 6 (4,2; 5,1; 3,3). Next use X's to show one of the three sets of component groups under the pictures. Ask the children which picture the X's match. Erase them and do the same thing with another set of component groups, and then with the third set. If necessary, repeat this procedure

several times. The children should understand that they are to match the X's with the pictures according to the number of objects in the subgroups and that the arrangement of objects is not important as long as the subgroups are the same. Have them open their books to page 57, and tell them they are going to do the same thing on this page that they did with the pictures on the board. Proceed with detailed instructions for the page. Be sure the children observe that some of the pictures do not show 6 objects.

The brown strip at the right of the page will be used with page 59.

A tissue overlay may be used to check this page.

## 58 Comments

On this page the children make groups of 7 by selecting a component group and combining it with a key group.

The children begin their study of component groups of 7 on this page. These are the pairs of groups (6,1; 2,5; 3,4) that can be combined to make 7 and into which 7 can be separated. The page is similar in technique and purpose to page 56. The children combine a key group of objects with a group of objects they select to make a group of 7 in all.

Introduce the page by showing the children the difference between a group of 6 and a group of 7 by using objects or pictures on the board. Arrange 6 X's (or markers) as one set of the component groups of 6, and then add one more to make a group of 7. Do this several times, using all the pairs of component groups of 6.

Have the children open their books to page 58. Tell them that this page is like page 56, except they are to make groups of 7. Work through the first picture, and let them finish the page independently.

There are several correct ways of doing most of the exercises on this page. You may check each child's worksheet, or you may let the children discuss and correct their own work.

## 59 Comments

On this page the children practice recognition of the component groups of 7.

This page is similar to page 55. The brown strip from page 57 is used, and the technique for using it is the same as that described in the notes for Worksheet 7, pages 6-7.

Introduce Worksheet 59 by asking the children to look at the top row of pictures (the rabbits). First ask if there are 7 rabbits in any of the pictures. Then have them place the brown strip in position and proceed as usual.

If a slow group needs to use markers with the first strip or two, let them. Try to get them to do at least part of the page without markers.

A tissue overlay may be used to check this page.

## 60 Comments

This page provides experience in distinguishing among the various pairs of component groups of 7.

This page is similar to page 57. The children develop knowledge of the component groups of 7 by distinguishing among the various pairs of component groups.

Introduce this page by asking three children, in turn, to show one set of the component groups of 7 by making X's on the board. When all three sets of the component groups of 7 are on the board, ask the children to open their books to page 60. Ask them which set of groups on the board matches the first key picture on the page, which set matches the second

key picture, etc. Remind them that page 57 was like this, only it showed groups of 6. Ask them to tell you what they are to do with the page. If they are wrong, correct them, and if they have forgotten anything, be sure to remind them. A very slow group may need to be given detailed directions.

A tissue overlay may be used to check this page.

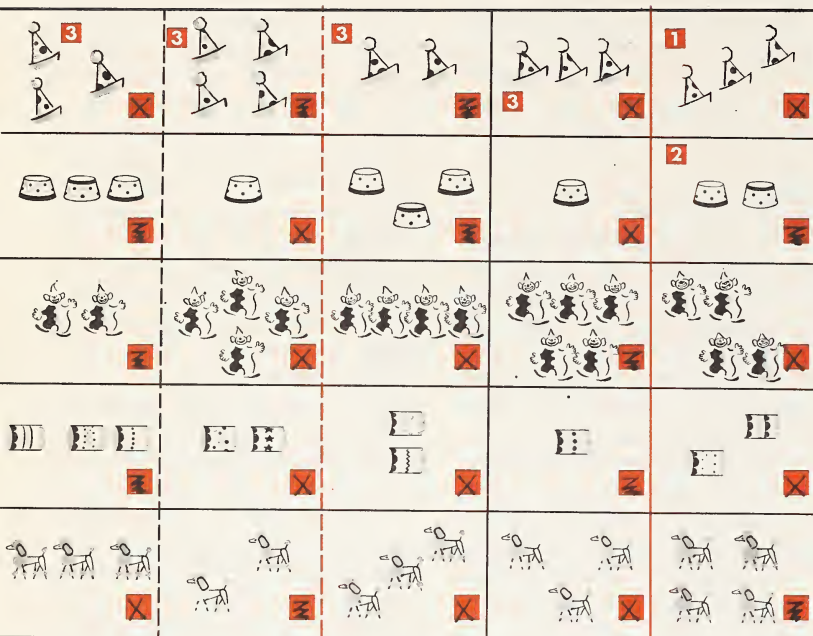
## 61 Comments

On this page the children review recognition of groups 3 to 7.

This page is a simple review of group recognition. The model groups 3 and 4 are included and as many as possible of the component groups of 5 to 7 are pictured. These exercises will give you a chance to find out whether any of the children need more practice in recognizing groups, or whether they are ready to go on to the next set of pages, on which new material is introduced.

Introduce this page by drawing simple objects or X's on the board to show groups of 3, 4, 5, 6, and 7. Under each group write the numerals 3 to 8. Ask one child at a time to come to the board, tell the number of objects in one of the groups, find that numeral, and draw a ring around it. Point out that the exercises on page 61 are like the exercises they just did on the board. Erase the material on the board, and let the children proceed with the work in their books.

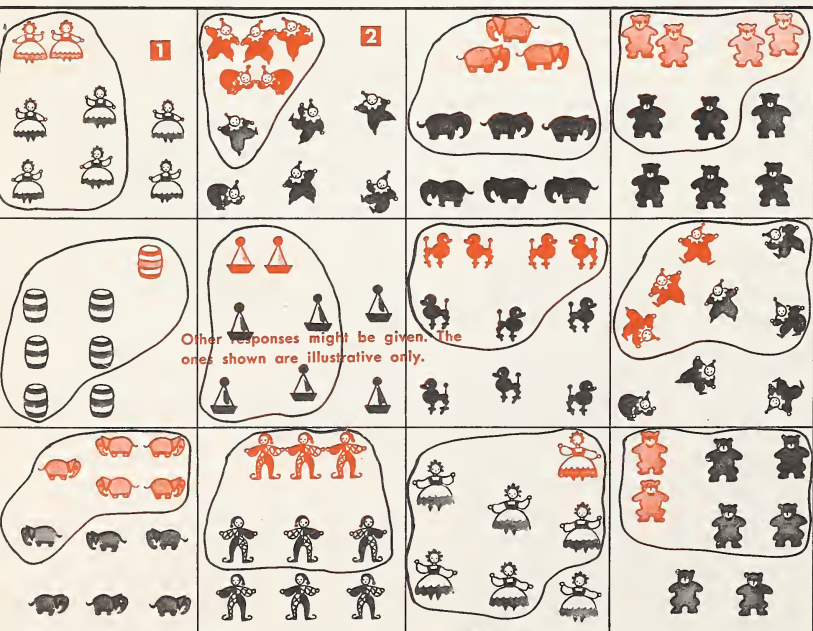
A tissue overlay may be used to check this page.



1 Have the children place the brown key strip from page 53 in position against the solid brown line on page 55. Direct attention to the pictures of the hats at the top. Ask the children to look at both pictures and decide if there are 6 hats in all. Tell them that if there are 6 hats in all, they are to put an X in the brown square in the white picture; if there are not 6 hats, they are to make a scribble mark in the square.

2 Ask them to look at the other pairs of pictures below the hats and decide whether or not there are 6 objects in all in each pair of pictures, then to put the correct mark in the square.

3 Have them place the strip in the other four positions and follow the same procedure.



1 Get the children to observe that some of the toys in each picture are printed in brown. Direct attention to the first picture. Tell the children that they are to draw a ring around 6 dolls by using all the brown dolls and just enough of the other dolls to make a group of 6 in all. Remind them to choose black dolls that are close together and close to the brown dolls.

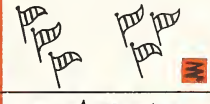
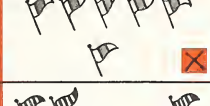
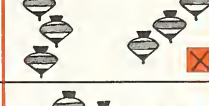
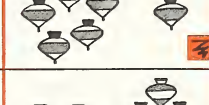
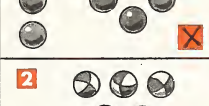
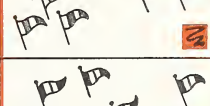
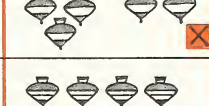
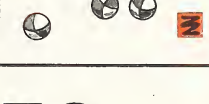
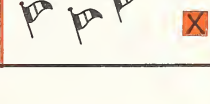
2 Have them encircle a group of 6 objects in each of the other pictures on the page. Be sure they understand that in each picture they must use all the brown toys in the group they encircle.

# 57

1 Direct attention to the three brown pictures at the top of the page. Get the children to observe that there are 6 objects in each picture, but that each picture shows a different pair of groups.

2 Ask the children to look at the black pictures of balls under the brown picture of balls. Tell them they are to decide, for each black picture, whether it also shows a group of 4 and a group of 2. If it does, they are to make an X in the brown square; if it does not, they are to make a scribble mark in the square. Be sure the children know that the groups do not have to be arranged in the same pattern and that they notice that one of the pictures shows only 5 balls.

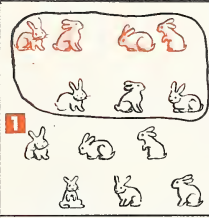
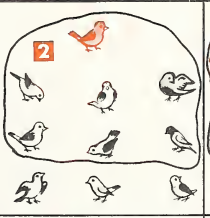
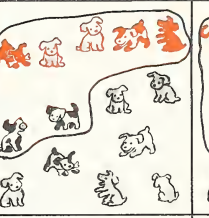
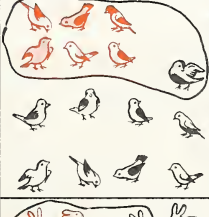
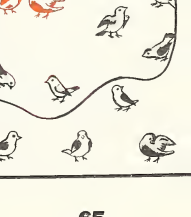
3 Adapt Notes 1 and 2 to this column of pictures.

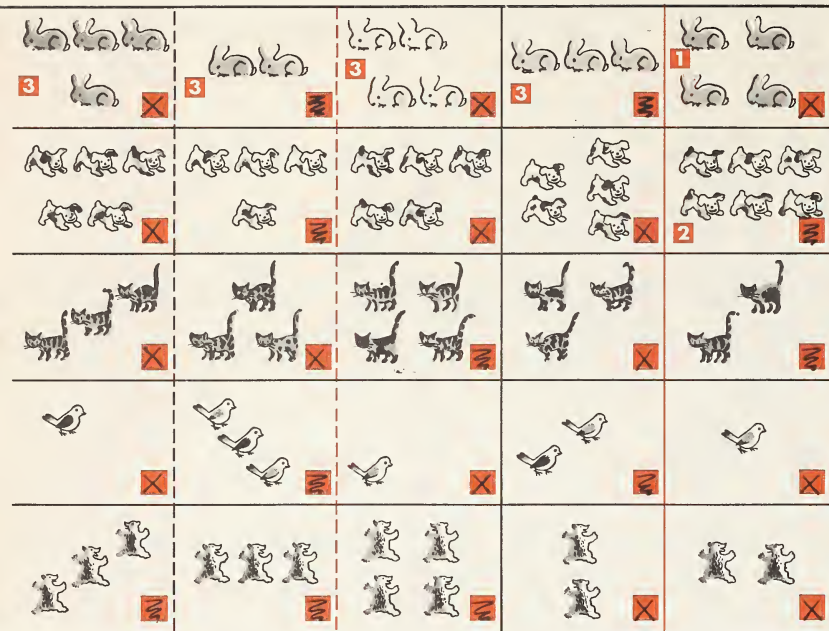
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# 58

1 Get the children to observe that some of the animals in each picture are printed in brown. Direct attention to the first picture. Tell the children that they are to draw a ring around 7 rabbits by using all the brown rabbits and just enough of the black rabbits to make a group of 7 in all. Remind them to choose black rabbits that are close together and close to the brown rabbits.

2 Have them encircle a group of 7 in each of the other pictures on the page. Be sure they understand that in each picture they must use all the brown animals in the group they encircle.

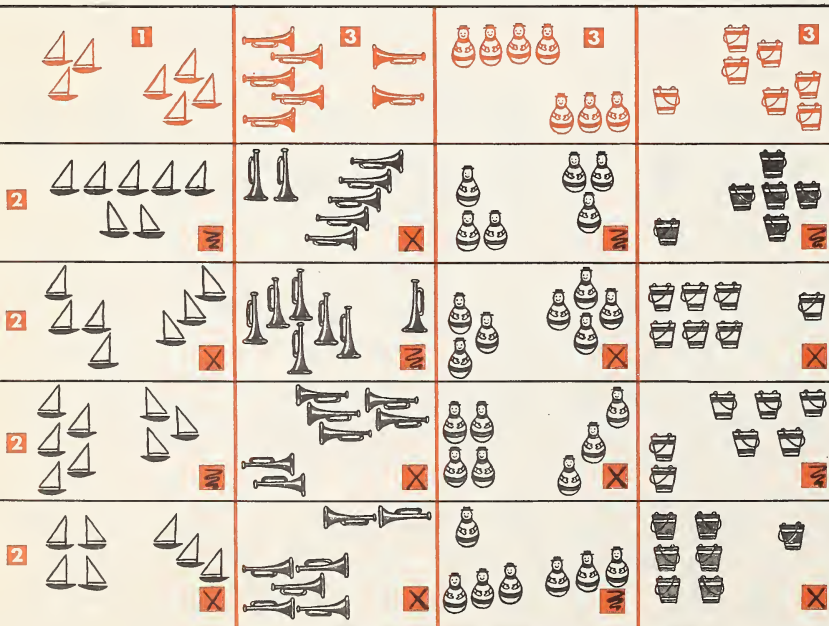
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1 Have the children place the brown key strip from page 57 in position against the solid brown line on page 59. Direct attention to the pictures of the rabbits at the top. Ask the children to look at the rabbits in both pictures and decide whether there are 7 in all. If there are 7 in all, they are to put an X in the brown square in the corner of the white picture; if there are not, they are to make a scribble mark in the square.

2 Ask them to look at the other pairs of pictures formed by the brown key strip and the white strip; then decide whether there are 7 objects in all in each pair of pictures, and put the correct mark in the square.

3 Have them follow the same procedure for the other four positions of the strip.



1 Direct attention to the four brown pictures at the top of the page. Get the children to observe that there are 7 objects in each picture, but that each picture shows a different pair of groups.

2 Ask the children to look at the black pictures of boats under the brown picture of boats. Tell them they are to decide, for each black picture, whether it also shows a group of 4 and a group of 3. If it does, they are to make an X in the brown square; if it does not, they are to make a scribble mark in the square. Be sure the children know that the groups do not have to be arranged in the same pattern and that they notice that one of the pictures shows more than 7 boats.

3 Adapt Note 2 to this column of pictures.

# 61

1 Let the children examine and discuss the page for a moment. Then direct attention to the first picture. Ask the children to look at it, decide how many clowns there are, find the numeral below the picture, and encircle it. Examine their work to see that they understand and are responding correctly.

2 Ask the children to follow the same procedure for the other pictures on the page.

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| <br>3 4 5 <b>6</b> 7 8 | <br>3 4 5 6 7 8        | <br>3 4 <b>5</b> 6 7 8 | <br>3 4 5 6 <b>7</b> 8 | <br>3 <b>4</b> 5 6 7 8 |
| <br>3 4 5 6 <b>7</b> 8 | <br>3 4 <b>5</b> 6 7 8 | <br>3 4 5 6 <b>7</b> 8 | <br><b>3</b> 4 5 6 7 8 | <br>3 4 <b>5</b> 6 7 8 |
| <br>3 <b>4</b> 5 6 7 8 | <br>3 4 5 <b>6</b> 7 8 | <br>3 4 <b>5</b> 6 7 8 | <br>3 4 5 6 <b>7</b> 8 | <br>3 4 5 <b>6</b> 7 8 |
| <br>3 4 5 <b>6</b> 7 8 | <br>3 4 5 6 <b>7</b> 8 | <br>3 <b>4</b> 5 6 7 8 | <br>3 4 5 <b>6</b> 7 8 | <br>3 4 <b>5</b> 6 7 8 |

## 62 RECOGNITION OF 9 AS 3,3,3

### Objectives

Nine is the only odd number less than 10 that has equal subgroups. The equal subgroups of 9 are special in another way. The number of subgroups is the same as the number in each subgroup. Nine is similar to 4 in that 4 can also be separated into equal subgroups in which the number of subgroups and the number in each subgroup is the same. The children will find the component groups of 9 easy to deal with if they have learned to see 9 as 3,3,3.

### Preliminary Teaching

Before using Worksheet 62, the children must be able to recognize a group of 9, to separate it into 3 groups of 3, and to join 3 groups of 3 to make a group of 9.

First, using markers, flash cards, or X's on the board, review 6 as 3,3 and 8 as 3,3,2. Be sure the children can separate groups of 6 and 8 into these subgroups and join them to make groups of 6 and 8.

Give the children 9 markers each. Say: "Make 2 groups of 3 markers each. How many markers is that in all? Now put another group of 3 markers near them. How many markers is that in all? Arrange the markers in 3 rows of 3 markers each. Now push the rows together so that they look like a square. How many markers are there in all? Now separate the markers in the square into 3 groups. How many markers are there in each group? How many groups are there? Is there something special about this way of grouping markers?" Try to

get the children to say that the number of groups and the number of markers in each group is the same.

"Now make 2 groups of 3 markers each again. How many markers are there in all? Put a group of 2 near them. Now how many markers are there in all? A group of 6 and a group of 2 is how many in all? Put one more marker with the group of 2 markers. How many markers are there in that group now? How many groups are there? How many markers are there in each group? How many markers are there in all? Three groups of 3 markers each is how many markers?"

Have the children find as many different ways as they can of arranging 3 groups of 3 markers each. They should be able to see 3 groups of 3 and recognize them as 9, no matter what pattern the markers form.

Have the children arrange the markers in 3 rows of 3 again [in a "square"]. Get the children to see that no matter which way the rows are counted, there are still 3 markers in each row. This emphasizes the fact that the number of groups and the number of markers in each group are the same.

Finally, give the class some practice in recognizing random groups of 9 without arranging the groups manually. Markers thrown on a table, flash cards, or X's or circles drawn on the board may be used for this work.

Most groups will profit by spending at least one full arithmetic period on this preliminary work. The importance of the children's being able to recognize groups and to see the subgroups in them instantly, without counting, cannot be too strongly em-

phasized. The more adept they become in this, the better their grasp of the more complicated aspects of arithmetic will be.

[Worksheet 62 can be used at this point.]

## 62 Comments

On this page the child learns to build up 9 from groups of 3,3,3.

The equal subgroups of 9 are not component groups since there are more than two, but they can be regrouped to make the two sets of component groups, 3,6 and 6,3. (All the component groups of 9 are presented on page 66.)

Introduce this page by discussing with the children the instruments they would use to play in a rhythm band. Use some rhythm band instruments to show a group of 9. Let the children

put them in groups according to your directions. Bring out the fact that 9 is different from the odd numbers 3, 5, and 7. (Do not use the word "odd.") Show them that 9 can be separated into 2 equal groups with one extra and that it can also be separated into 3 equal groups. Ask them to open their books and explain what they are to do with the page.

Because of the number of correct ways to circle groups in each exercise, you should check each child's worksheet or let the children discuss and correct their own or one another's work.

# 62



1 Direct attention to the first picture. Tell the children they are to draw rings around as many groups of 3 as they can. Remind them that the triangles they choose for each group should be close together. Ask them to decide whether or not there are just 9 triangles in the picture. Point out that if there are 3 groups of 3 there will be just 9 triangles. If there are 9 triangles in the picture, they are to put an X in the response square. If there are not, they are to make a scribble mark in the response square.

2 Have them follow the same procedure for the other pictures on the page.

## 63-73 COMPONENT GROUPS OF 8, 9, AND 10

### Objectives

The introduction of the component groups of numbers up to 10 is completed in this section. Some of the component subgroups for 8 and 9 have already been studied (8 as 4,4; 9 as 8,1; 10 as 5,5). On the pages that follow, the children review these groups and learn the other component groups of 8, 9, and 10.

### Preliminary Teaching

Before using Worksheets 63-73, the children must be able to recognize groups of 8, 9, and 10, to make them by joining pairs of groups, and to separate them into pairs of groups.

First, using markers, X's on the board, or flash cards, review groups of 5, 6, and 7 and the component groups for these numbers. Next give each child a handful of markers (buttons, shell macaroni, small plastic disks, etc.). Ask the children to make a group of 6. Check to see that they all have the correct number, and spend a minute or two having them arrange their markers in the various subgroups of 6, ending with 3 groups of 2 markers each. Say: "How many markers are in each group? Let's count the markers by twos—two, four, six. Now add another group of 2 markers. How many are there in all now? Six markers and 2 more markers make a group of 8 markers. (Now move 3 of the markers away from the others. How many markers are there in the group you did not move? How many markers are there in all? A group of 5 and a group of 3 make a group of 8. Make as many groups of 6 and 2, and 5 and 3 as you can with the markers on your desks."

Let the children compare their various arrangements of markers. Then, using techniques similar to those suggested above, introduce 8 as 7,1.

Give the children a variety of practice in forming and recognizing the component groups of 8. Let small groups of children play a game in which they take turns calling out one of a pair of component groups of 8 while the other children show with markers the two groups of the pair. For example, one child might call out "three" and the other children make a group of 5 and a group of 3.

[Worksheets 63, 64, and 65 can be used at this point.]

Use the techniques described above to introduce the component groups of 9. First review quickly recognition of groups of 5, 6, 7, and 8. Then introduce 9 as 5,4; as 6,3; and as 7,2. Give the children as much experience as possible in manipulating markers to make these groups.

[Worksheets 66, 67, and 68 can be used at this point.]

Use the same techniques to introduce the component groups of 10. Start by reviewing briefly recognition of groups of 5, 6, 7, 8, and 9. Emphasize the fact that 10 is one of the numbers that can be built up by twos. Then introduce 10 as 7,3; 6,4; 5,5; and 9,1. Be sure the children get enough practice in recognizing groups of 10 and in manipulating objects to make groups of 10 by joining component groups and to separate groups of 10 into component groups.

[Worksheets 69, 70, 71, 72, and 73 can be used at this point.]

## 63 Comments

On this page the children make groups of 8 by selecting a component group and combining it with a key group.

The children begin their study of the component groups of 8 on this page. These are the pairs of groups

that can be combined to make 8 and into which 8 can be separated (1,7; 2,6; 3,5; 4,4). The page is similar in technique and purpose to page 56. The children combine a key group of objects with a group of objects they select to make a group of 8 in all.

Introduce this page by using markers or X's on the board to review quickly the component groups of 8. Then ask the children to open their books to page 63 and tell what they think they are going to do. Make X's on the board in the same pattern shown for the bats in Picture 1. Have the children tell the different ways that a group of 8 can be made.

A slow group may need to use markers with some of the exercises.

The brown strip at the right of the page will be used later with another page.

You may let the children discuss the exercises and correct their own work.

## 64 Comments

On this page the children get experience in distinguishing among the various pairs of component groups of 8.

This page is similar to page 57. The children develop their knowledge of the component groups of 8 by distinguishing among the pairs of component groups. They do this by deciding whether the numerosness of the subgroups in a picture match the numerosness of the subgroups in a key picture.

Introduce the page by reviewing briefly the component groups of 8. Emphasize the different ways subgroups with the same number of objects in them can be arranged. Ask them to look at page 64 and tell what they think is to be done with it.

A tissue overlay may be used to check this page.

## 65 Comments

On this page the children practice recognition of the component groups of 8.

This page is similar to page 55. The brown strip from page 63 is used, and the technique for using it is the same as that described in the notes for Worksheet 7. The blue strip at the right is to be used later.

Introduce Worksheet 65 by asking the children what groups make a group of 8 in all. Let them show the component groups of 8 by using markers or making X's on the board. Then have them turn to page 65.

A tissue overlay may be used to check this page.

## 66 Comments

On this page the children make groups of 9 by selecting a component group and combining it with a key group.

The children begin their study of the component groups of 9 on this page. It is similar to page 63 in purpose and technique.

Introduce this page by drawing on the board 3 groups of 3 objects (or X's). Ask the children how many groups there are, how many objects in each group, and how many in all. Erase one object from one of the groups and put it with one of the other groups, then do the same with the two remaining objects in that group. Again ask the children how many groups there are, how many in each group, and how many in all. Show all the component groups of 9 in this way.

If the children need help in recognizing the component groups of 9 when they are doing the exercises on the page, let them use markers. Encourage them to do at least part of the exercises without markers. Let the

children discuss and correct their work.

## 67 Comments

On this page the children practice recognition of the component groups of 9.

This page is similar to page 55. The blue strip from page 65 is used, and the technique for using it is the same as that described in the notes for Worksheet 7. The blue strip at the right of the page is to be used later.

Introduce Worksheet 67 by showing the children a set of cards you have made, each of which shows one of the subgroups of the component groups of 9. Make several sets. Be sure the pictures or symbols used on the cards give no clue as to which two cards are a pair. Let the children take turns selecting two cards that together make a group of 9, and put them in the chalkboard tray. Have them open their books to page 67 and tell what they think they are to do.

A tissue overlay may be used to check this page.

## 68 Comments

On this page the children get experience in distinguishing among the various pairs of component groups of 9.

This page is similar to page 64 in purpose and technique.

Introduce this page by asking the children what number group they have been working with the last few days. Have several children come to the board and make X's to show the various pairs of component groups of 9. Ask the children to look at page 68 and tell what they think they are to do.

A tissue overlay may be used to check this page.

## 69 Comments

On this page the children learn to recognize the component groups of 10 as 9,1; 8,2; 7,3; 6,4; and 5,5.

This page is similar to page 55. The blue strip from page 67 is used in the usual way.

The children begin their study of the component groups of 10 by combining a group with a key group and deciding whether there are 10 objects in all. This should be done visually, not by counting.

Introduce the page by reviewing the component groups of 9. Use marks on the board or markers that are large enough for all the children to see easily. Make two groups of 4 with one extra to make 9, then add one more to make 10. Get the children to observe that there are now two groups of 5.

It may be necessary to let a particularly slow group use markers with the first two or three strips. Encourage these children, however, to do at least some of the exercises on the page without markers.

A tissue overlay may be used to check this page.

## 70 Comments

On this page the children make groups of 10 by selecting a component group and combining it with a key group.

This page is similar in purpose and technique to page 63. The children combine a key group of objects with a group of objects they select to make a group of 10 in all.

Introduce this page by reviewing briefly the component groups of 10. Use large markers or simple objects drawn on the board. The children have had this type of page so often that they should have no difficulty in following the directions.

Let the children discuss their work and see how many different ways of making a group of 10 the other children have found.

## 71 Comments

On this page the children get experience in distinguishing among the pairs of component groups of 10.

Introduce this page by asking the children to tell what is to be done. By this time they should be thoroughly familiar with this type of page. Be sure they realize that they are working with groups of 10.

A tissue overlay may be used to check this page.

This page provides practice in group recognition for the children and gives the teacher a way of evaluating their ability to recognize groups. If any child is not able to recognize groups of 5 to 10 at this point, he must be given further work before he goes on to the next unit. The page also provides practice in recognizing number symbols.

Introduce the page by telling the children what they are to do. Any review or discussion of the pictures would defeat the purpose of the page. Be sure they know they will find groups of 5, 6, 7, 8, 9, and 10.

A tissue overlay may be used to check this page.

This is the last of the series of pages devoted to recognition of groups that began on page 55. It is designed to give the teacher a way of evaluating the children's ability to recognize component groups for the numbers 5 to 10. A secondary aim is to test their ability to recognize numerals.

Introduce this page by explaining carefully to the children what they are to do. Since this page is planned to measure the children's ability to recognize groups and number symbols, no other introduction is necessary.

Each child's work should be checked and evaluated individually.

## 72 Comments

On this page the children review recognition of groups of 5 to 10.

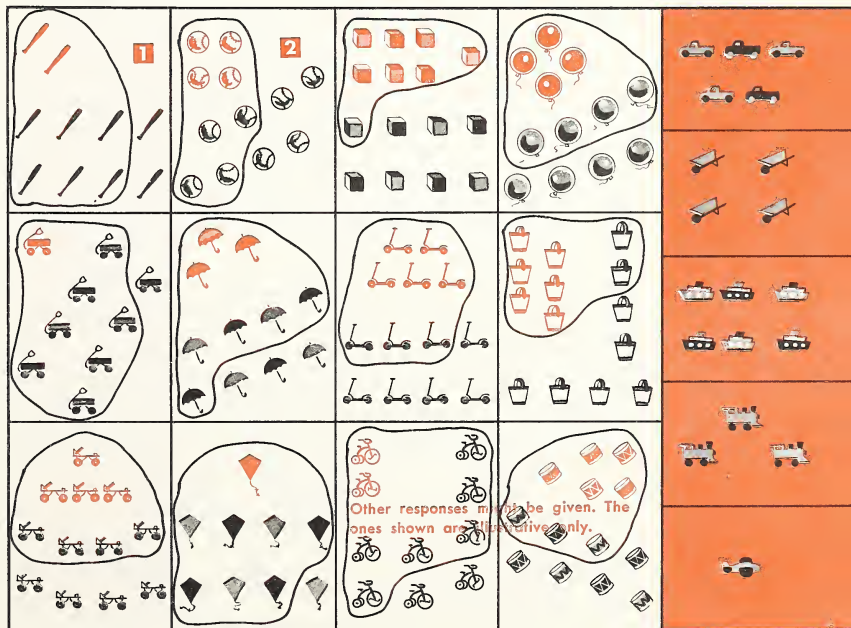
## 73 Comments

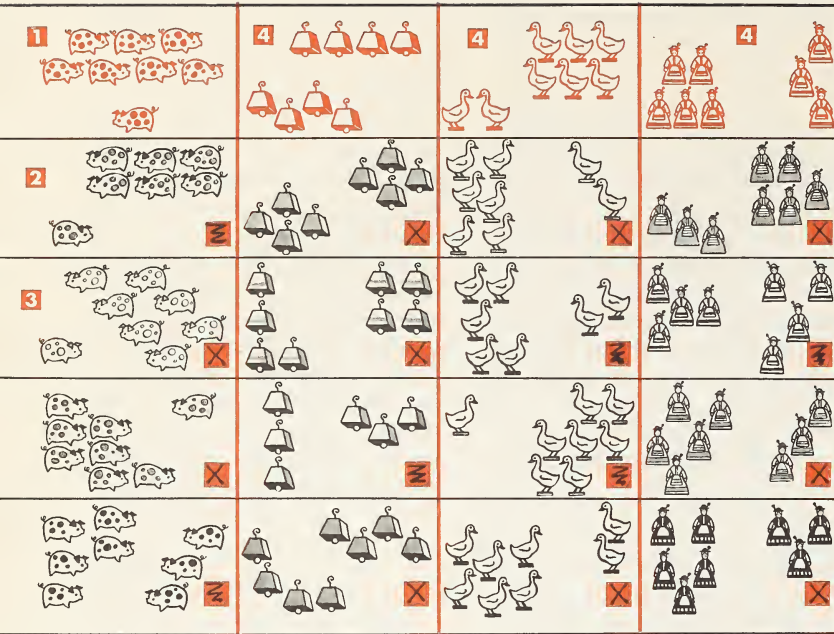
On this page the children review recognition of groups of 5 to 10.

# 63

1 Get the children to observe that some of the objects in each picture are printed in brown. Direct attention to the first picture. Tell the children that they are to draw a ring around 8 bats and that they are to use all the brown bats and just enough of the other bats to make a group of 8 in all. Remind them that the black bats they choose should be as close to the brown bats as possible.

2 Have them encircle a group of 8 in each of the other pictures on the page in the same way. Be sure they understand that they must use all the brown objects in each picture.



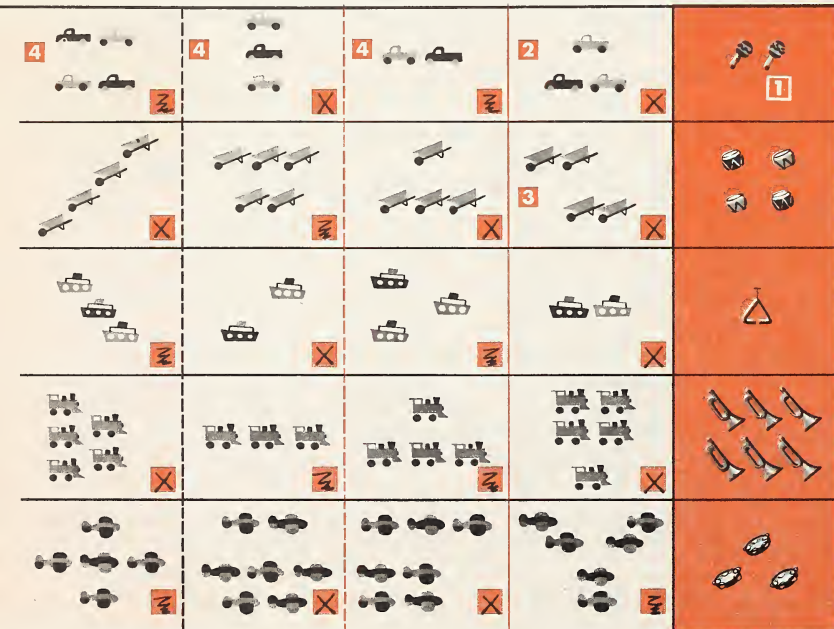


1 Direct attention to the four brown pictures at the top of the page. Get the children to observe that there are 8 objects in each picture, but that each picture shows a different pair of groups.

2 Ask them to look at the black picture of pigs under the brown one and decide if the black picture also shows a group of 7 and a single pig. If it does, they are to put an X in the brown square in the corner of the picture; if it does not, they are to make a scribble mark in the square.

3 Tell them to look at the other pictures of pigs and follow the same procedure. Make it clear that the pigs should be in a group of 7 and a single pig but that it does not matter how the groups are arranged.

4 Adapt Notes 2 and 3 to this column of pictures.



1 Tell the children that the blue strip at the right of the page will be used later with another page.

2 Have the children place the brown key strip from page 63 in position against the solid blue line on page 65. Direct attention to the pictures of the cars at the top. Ask the children to look at both pictures and decide if there are 8 cars in all. Tell them that if there are 8 cars in all, they are to put an X in the blue square in the white picture; if there are not 8 cars, they are to make a scribble mark in the square.

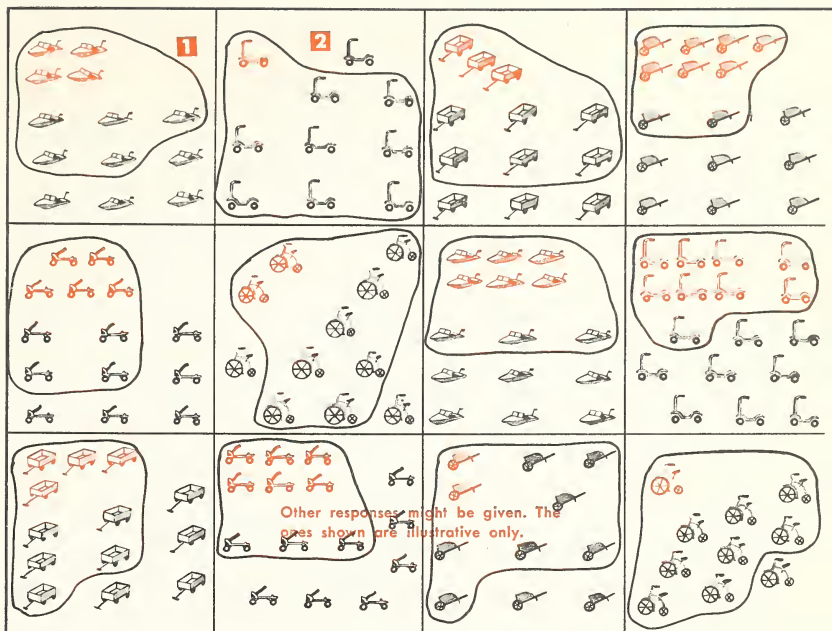
3 Ask them to look at the other pairs of pictures below the cars and decide whether there are 8 objects in all in each pair of pictures, then to put the correct mark in the square.

4 Have the children place the strip in the other three positions and follow the same procedure.

# 66

1 Get the children to observe that some of the objects in each picture are printed in blue. Direct attention to the first picture. Tell the children that they are to draw a ring around 9 boats and that they are to use all the blue boats and just enough of the other boats to make a group of 9 in all. Remind them to choose black boats that are close together and close to the blue boats.

2 Have them encircle a group of 9 objects in each of the other pictures on the page. Be sure they understand that in each picture they must use all the blue objects in the group they encircle.



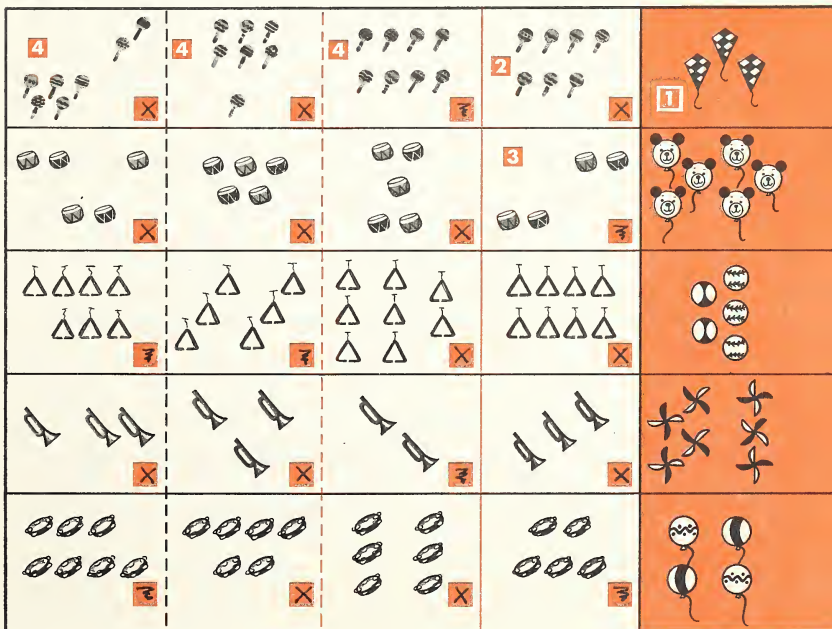
# 67

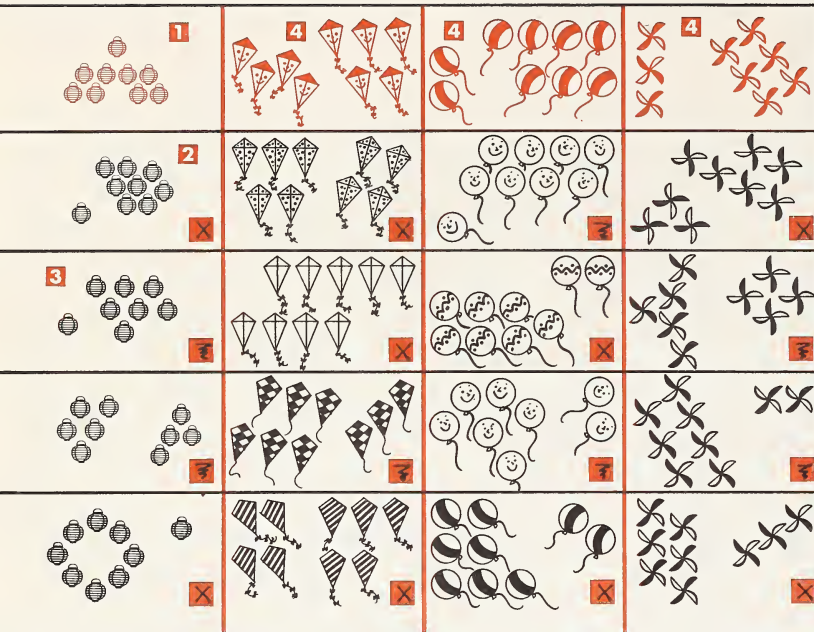
1 Tell the children that the blue strip at the right of the page will be used later with another page.

2 Have the children place the blue key strip from page 65 in position against the solid blue line on page 67. Direct attention to the two pictures at the top. Ask the children to look at the gourd rattles in both pictures and decide if there are 9 in all. Tell them that if there are 9 in all, they are to put an X in the blue square in the corner of the white picture; if there are not 9, they are to make a scribble mark in the square.

3 Ask the children to look at the other pairs of pictures below the rattles, decide whether there are 9 objects in all in each pair of pictures, and make the correct mark.

4 Have the children place the strip in the other three positions and follow the same procedure.



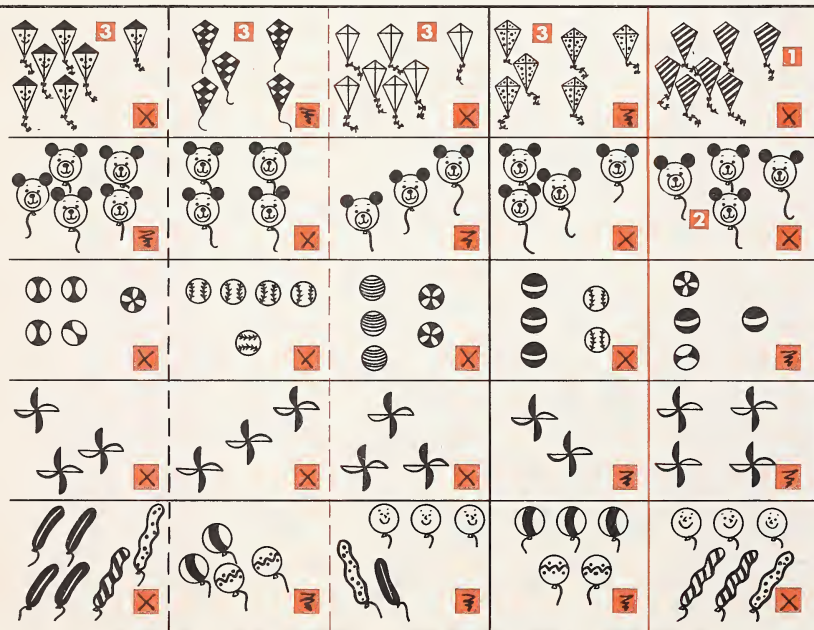


1 Direct attention to the four blue pictures at the top of the page. Get the children to observe that there are 9 objects in each of these key pictures, but that each picture shows a different set of subgroups.

2 Ask them to look at the black picture of lanterns under the blue lanterns and decide whether the black picture also shows a group of 8 and a single lantern. If it does, they are to put an X in the blue square; if it does not, they are to make a scribble mark in the square.

3 Tell the children to look at the other black pictures of lanterns and decide whether they show a group of 8 and a single lantern. Remind them that it does not matter if the group of 8 is arranged differently.

4 Adapt Notes 2 and 3 to this column of pictures.



1 Have the children place the blue key strip from page 67 in position against the solid blue line on page 69. Direct attention to the pictures of the kites at the top. Ask the children to look at the kites in both pictures and decide if there are 10 in all. Tell them that if there are 10, they are to put an X in the blue square; if there are not, they are to make a scribble mark in the square.

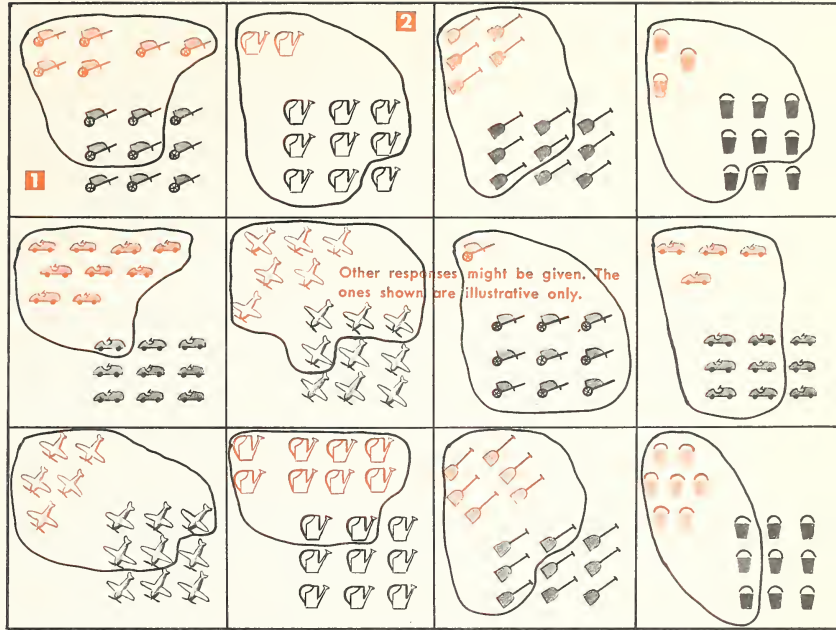
2 Ask the children to look at the other pairs of pictures below the kites, decide whether there are 10 objects in all in each pair of pictures, and put the correct mark in the square.

3 Have the children place the strip in the other four positions and follow the same procedure.

# 70

1 Get the children to observe that some of the objects in each picture are printed in blue. Direct attention to the first picture. Tell the children that they are to draw a ring around 10 wheelbarrows and that they are to use all the blue wheelbarrows and enough of the black wheelbarrows to make a group of 10 in all. Remind them to choose black wheelbarrows that are close to the blue wheelbarrows.

2 Have the children encircle a group of 10 in each of the other pictures on the page. Be sure they understand that they must include all the blue objects.



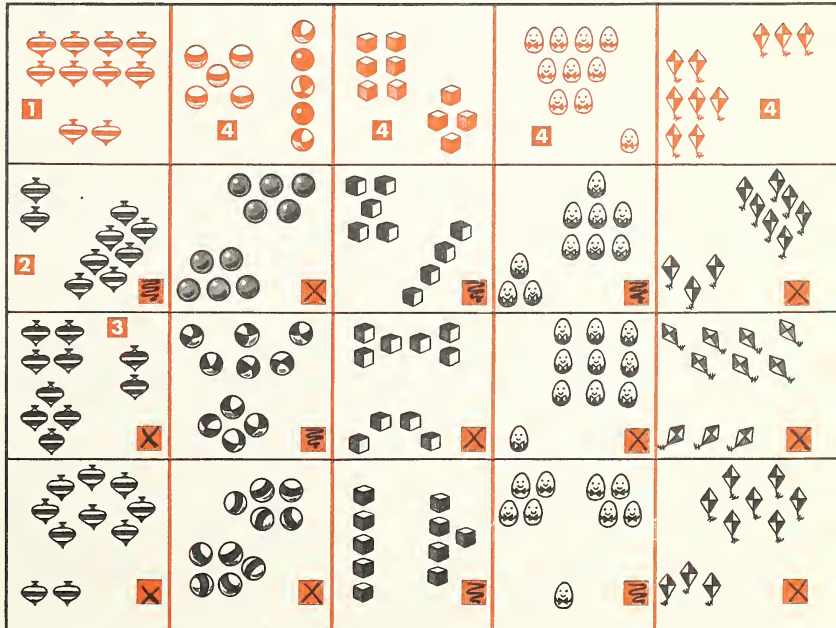
# 71

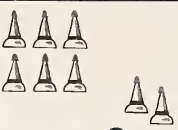
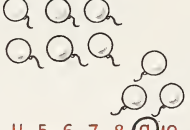
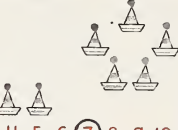
1 Direct attention to the five blue pictures at the top. Get the children to observe that there are 10 objects in each picture, but that each one shows a different pair of groups.

2 Ask them to look at the black picture of tops under the blue one and decide if the black picture also shows a group of 8 and a group of 2. If it does, they are to put an X in the blue square in the corner of the picture; if it does not, they are to make a scribble mark in the square.

3 Tell the children to compare each of the other pictures of tops with the blue tops. Be sure they understand that they write an X if a black picture shows a group of 8 and a group of 2, but that it does not matter how the groups are arranged.

4 Adapt Notes 2 and 3 to this column of pictures.

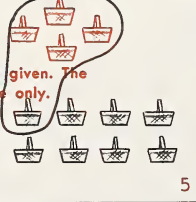
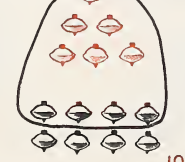


|                                                                                                                                                                                                                                |                                                                                                                                |                                                                                                                |                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
|  <p><b>1</b></p>  <p><b>2</b></p> <p>4 5 6 <b>7</b> 8 9 10</p> | <p><b>3</b></p>  <p>4 <b>5</b> 6 7 8 9 10</p> |  <p>4 5 6 7 8 9 <b>10</b></p> |  <p>4 5 6 7 <b>8</b> 9 10</p> |
|  <p>4 5 6 7 <b>8</b> 9 10</p>                                                                                                                  |  <p>4 5 <b>6</b> 7 8 9 10</p>                 |  <p>4 5 6 7 <b>8</b> 9 10</p> |  <p>4 <b>5</b> 6 7 8 9 10</p> |
|  <p>4 5 6 7 8 9 <b>10</b></p>                                                                                                                  |  <p>4 5 6 <b>7</b> 8 9 10</p>                 |  <p>4 5 6 7 8 <b>9</b> 10</p> |  <p>4 5 6 <b>7</b> 8 9 10</p> |
|  <p>4 5 6 7 <b>8</b> 9 10</p>                                                                                                                  |  <p>4 5 6 7 8 9 <b>10</b></p>                 |  <p>4 5 6 7 8 <b>9</b> 10</p> |  <p>4 5 <b>6</b> 7 8 9 10</p> |

**1** Direct attention to the picture of the boats. Tell the children to decide without counting how many boats there are.

**2** Ask them to find among the blue numerals below the picture the numeral that tells how many boats there are and draw a ring around it.

**3** Explain that for each picture they are to look at the objects in the picture, decide without counting how many in all there are, find that numeral among the blue numerals below the picture, and encircle it.

|                                                                                                            |                                                                                                                                                                           |                                                                                              |                                                                                              |
|------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
|  <p><b>1</b></p> <p>5</p> |  <p><b>2</b></p> <p>7</p>                                                               |  <p>10</p> |  <p>9</p>  |
|  <p>6</p>                |  <p>Other responses might be given. The ones shown are illustrative only.</p> <p>9</p> |  <p>5</p> |  <p>7</p> |
|  <p>8</p>                |  <p>10</p>                                                                             |  <p>9</p> |  <p>8</p> |

**1** Direct attention to the picture of the dolls. Tell the children that the blue numeral in the corner of the picture means that they should make a group of 5 dolls in all. They are to use all the blue dolls and as many black dolls as they need to make a group of 5 and draw a ring around them.

**2** Have the children do the same for each of the other pictures on the page. Be sure they understand that they must use all the blue objects in a picture and enough black objects to make a group of the size indicated by the numeral in the corner of the picture.

## 74-80 NUMBER SYMBOLS TO 100

### Objectives

The principles of the decimal numeral system are introduced on the following pages. Understanding the numbers above 10 and the four fundamental arithmetic processes—addition, subtraction, multiplication, and division—depends upon understanding these principles. The two basic ideas of the numeral system are: first, grouping by tens; second, using the same symbols to represent ones, tens, hundreds, thousands, etc., and showing by position which of these the symbols represent. These principles of grouping and place value are shown clearly in our written numerals and in our number words. For example, "4" stands for 4 ones, "44" stands for 4 groups of 10 and 4 ones, and the words "forty-four" are a short way of saying "four groups of ten and four ones." On the following pages the children are taught to group by tens, to count the groups of 10 as they count ones, to record the number of tens and the number of ones by using tally marks, and to read and understand the number symbols for the numbers to 100.

### Preliminary Teaching

Before using Worksheets 74-80, the children must learn to make groups of 10 and count them in the same way they count ones, to count groups of 10 and ones, to show how many groups of 10 and how many ones by making tally marks in the correct relative position to show place value, and to read and interpret correctly the symbols that represent the numbers greater than 10. These pages deal with numbers to 100.

The children will need objects that can be piled or stacked—small cubes or peg sticks—and each child should have at least 50. The first part of the

preliminary teaching should be devoted to getting the children to accept a pyramid with 4 objects as its base, 3 objects in the next row, 2 in the third row, and one object on top as a standard group of 10. This will enable you to show the children how to count and record the groups of 10 without having to discuss the numerosness of the group each time.

First, using blocks or other objects, build a pyramid in the 4, 3, 2, 1 arrangement in a place where all the children can see it. Discuss the number of blocks in the pyramid. Let the children count them and make similar pyramids with their objects. Let them continue until you are sure all the children know there are 10 objects in such a pyramid and will recognize it as a group of 10.

Next, build another pyramid just like the first one. Say: "How many blocks are in the first pile? How many groups of 10 are there? When we have two groups of 10, we can count by tens and say 'ten, twenty.'" Let the children make a second pyramid on their desks and count the entire group as "ten, twenty." Conceal or remove one pile, and get them to say "ten" for whichever pile is left. They should understand that "ten" and "twenty" are not the names of the piles, but are words that tell how many objects have been counted.

Let the children count both piles of blocks, saying "ten, twenty." Then remove a block from the second pile. Get them to see that they cannot count this pile as another 10 because it does not have 10 blocks in it now. They cannot say "ten, twenty," but must say "ten and nine ones."

Divide the children into groups of 8 or 10 and give each group 50 objects. Use the techniques outlined above to introduce each of the de-

cade numbers up to 50. As the children make another pyramid of blocks, get them to accept it as one more ten, and teach them the decade name (thirty, forty, fifty). Teach the children to count the stacks of blocks or objects by tens, and be sure they understand that there must be 10 objects in each group before they can be counted in that way. Also they must understand that the new number words tell how many objects there are and are not names for special piles.

[Worksheet 74 can be used at this point.]

Use the techniques outlined above to introduce the decade numbers from 60 to 100. Be sure to give the children plenty of practice with the first five decades as you are working with the second five decades.

[Worksheet 75 can be used at this point.]

Make several piles of 10 in the familiar pyramid shape. Ask the children how many blocks there are in each pile and how they know. (They should mention the 4, 3, 2, 1 arrangement.) Let them count the piles by tens. Then remove some blocks from one of the piles. Work with the children until they understand that they cannot count as another ten the pile that is no longer a pyramid. Ask them how many single blocks there are in the pile that is not a full ten.

Next, throw down a group of small objects that is more than 10 and less than 20. Ask a child to make a group of 10 and then to count the objects, saying "ten" for the pile, and "ten and one, or eleven; ten and two, or twelve; ten and three, or thirteen," etc. Let each child have a turn, and continue until the children can proceed satisfactorily with the "teen" numbers.

Set up three groups of 10 and some single objects and work with the children until they can count them

"thirty-three, thirty-four," etc. Vary both the decade number and the number of single objects within the decade to be counted for each child. Be sure the children understand the principle of counting decades and counting 9 or fewer single objects for less than a decade.

When the children can count tens and ones with reasonable facility, put a random group of objects on a table in the front of the room. Ask one child to make as many groups of 10 as he can and to count the ones that are left. Then say: "I am going to put a mark on the board for each single block." As the child counts the ones aloud, make a tally mark on the board for each object he counts. Then say: "Now I am going to make a mark on the board for each group of 10. We must not get the marks for the tens and the marks for the ones mixed up, so I will put the marks for the tens over here." Let the child count the groups by ten, and make a tally mark for each some distance to the left of the marks for the ones. Let several children recount the tens and the single objects and check the tally marks for each. Be sure to emphasize each time that the marks for the tens and the marks for the ones are the same kind of mark, but they are put in different places.

Have the children each take a sheet of paper and draw a line down the middle of it. Show them how to make marks for ones to the right of the line and marks for tens to the left of the line. Have them take turns making groups of 10 blocks on the table in front of the room and putting single blocks that are left over in a row. While one child is doing this, have the other children make tally marks on their papers for the ones and the tens. Ask several of the children how many marks for ones they have and how many marks for tens. Let the other

children check to see that they have the same number of marks and that they are in the correct position on the sheet. Each time another child comes up to make groups of blocks, vary the number of blocks on the table. Continue the activity until you see that all the children are tallying correctly. It is extremely important that they not only put down the correct number of tally marks, but that they put them on the paper in the proper position to show place value.

[Worksheets 76 and 77 can be used at this point.]

Give each child two sets of markers that have the numerals 1 to 9 and 0 written on them. Each child should have two markers with the numeral 1, two markers with the numeral 2, and so forth. Each child should also have a sheet of paper and a pencil.

Put some objects that can be piled or bundled on a table in front of the room, and ask two children to come forward. Have one child make several groups of 10 and some ones while the other child makes tally marks on the board, as they were taught to do in the previous lessons. Say: "Let's count the tally marks. Count the tens first. There are 4 tens. [Write 4 under the tally marks for the tens.] Now count the ones. There are 7 ones. [Write 7 under the tally marks for the ones.] Why did I write 4 where I did? [Get the children to say that there were 4 marks that meant tens, and 4 was written under them to show that it stood for four tens.] Why did I write 7 where I did?" [Get the children to say that there were 7 marks that meant ones, and 7 was written under them to show that it meant 7 ones.] Explain again that the numeral at the left stands for tens and the numeral at the right stands for ones. Then ask one of the children to read the numerals aloud, telling what each stands

for. Get him to say "4 tens and 7 ones." Next, ask the children to tell another way of saying "4 tens and 7 ones." Keep asking until they say "forty-seven." Be sure they understand that when they say a number in that way the word "forty" means "4 tens" and the word "seven" means 7 ones. Go through this procedure several times by having pairs of children make and tally groups of different sizes. If necessary, tell them how many tens and ones to make to be certain they work with a variety of decade and "teen" numbers.

Next divide the children into groups of 8 or 10 again and ask a child in each group to make groups of tens and ones with the objects on the table. Have the other children tally them on paper and use their numeral markers to show how many tens and ones there are. Say: "Take your peg sticks (or square beads) and make two groups of 10. Now put 4 single peg sticks next to them. Make a tally mark for each group of 10 on your sheet of paper. Now make a tally mark for each single stick. Be sure the tally marks for the tens are all together on the left of the page and the marks for the ones are all together on the right of the page. [Check their work.] How many marks for the groups of 10 do you have? Put the marker with the proper numeral on it under the tally marks for the tens. How many tally marks for the ones do you have? Put the marker with that numeral on it under the marks for the ones. Push these two markers together. What does the numeral on the left mean? What does the numeral on the right mean? What is another way of saying this number? [24]." Use this procedure with different groups of tens and ones, checking the work each time.

The children may now be permitted to make up their own groups,

tally them, and put the numeral markers in place under the tally marks. Or you might let the children in each group take turns giving the rest of the group the number to tally. Let them practice until you are sure they understand how to tally groups and read numerals to 100. This part of the work may take several days.

[Worksheets 78, 79, and 80 can be used at this point.]

## 74 Comments

On this page the children learn to see groups of 10 and to count to 50 by tens.

This page and the following six pages are designed to give the children some experience in counting by tens and to accustom them to accept the pyramid form shown on these pages as representing a group of 10.

Introduce this page by drawing 5 groups of 10 on the board or by stacking 5 groups of 10 blocks or boxes on the table. Have the children count them by tens as a quick review.

Directions for using this page are given, as usual, in the keyed notes. The reproduction of page 74 accompanying the keyed notes shows how the children should mark their pages and gives the decade numerals you will read to them as they work. If you do not work directly from the *Teaching Guide*, be sure to prepare your copy of *Our Number Workshop 1* by writing the numerals on the worksheet as they are given on the reproduced page.

A tissue overlay may be used to check this page.

## 75 Comments

On this page the children count to 100 by tens.

The practice in counting by tens started on the previous page is con-

tinued here, and the children learn to count to 100 by tens.

Introduce this page by drawing 10 piles of 10 on the board or by stacking 10 piles of 10 blocks or boxes on a table. Let the children practice counting them by tens a few times.

This page is like page 74, except that the decade numbers have been extended to 100.

A tissue overlay may be used to check this page.

## 76 Comments

On this page the children are introduced to numbers within the decades (45, 38, etc.) and learn to represent tens and ones by tally marks. They also learn to show by position whether the tally marks mean ones or tens.

Now that the children have learned to count by tens (on the two preceding pages), they are ready to learn to count and record numbers within the decades. On this and the following worksheet they are taught to make a tally mark on the left side of the blue response strip for each group of 10 shown in the familiar pyramid and to make a tally mark on the right side of the strip for each single object in the picture. No attempt should be made at this time to get them to interpret the tally marks as decade numerals. The children should read "four groups of ten and three ones" not "43" when they look at the tally marks. Emphasis should be placed on making a tally mark for each group of 10 and each single object, and, most important, on making them in the correct place so that the children begin to learn the meaning of place value.

Introduce the page by drawing on the board a rectangle divided into two sections like the response strip in the book. Make a mark on the

board to show the children what you mean by a tally mark. Make several pyramids of 10 blocks each on the table, and tell the children you are going to put a tally mark on the *left* side of the response strip [point to it] for each group of 10. Let one of the children count the blocks by tens as you make a tally mark for each pyramid. Erase the tally marks and repeat the procedure with a different number of piles of blocks. Then put some single blocks with the groups of 10 and tell the children that you are going to make a tally mark for each single block also, but that you are going to put them on the *right* side of the response strip [point to it]. Let one of the children count the ones as you put the tally marks on the board. Repeat this procedure several times, if necessary. Be sure the children understand that the tally marks on the left stand for groups of 10 and the tally marks on the right stand for ones. Ask them to open their books to page 76. Have them look at the page and tell what they think they are supposed to do.

When the children have finished the work on the page, be sure to discuss each picture with them. Let them take turns reading their responses for the various pictures. Be sure they always tell how many groups of 10 there are first.

## 77 Comments

On this page the children continue to make tally marks to represent groups of 10 and single objects, and to interpret the tally marks according to number and position.

The "Comments" for the previous page apply to this page also.

Introduce the page by reviewing briefly what was done on page 76. Ask the children to look at page 77 and tell you what they think they are

supposed to do. Be sure they count and tally the groups of 10 first, then the single objects.

Have them discuss their responses when they have finished the work on the page.

## 78 Comments

On this page the children continue to make tally marks to show groups of 10 and single objects. They learn to relate the tally marks to numerals and to identify these numerals.

The work the children did on the previous several pages in learning to count by tens, then by tens and ones, and to tally groups of tens and ones, is extended here and on the following two pages to recognition and understanding of the numerals into which the tally marks can be translated. They also learn to read these numerals in the usual way. "Four groups of ten and three ones" is now written and read "43." The children must understand that the "4" stands for four groups of 10. It is written on the left where the tally marks for groups of 10 were made, and it is read first, just as "four groups of ten" was read first. They must also understand that the "3" really means "three ones." Get the children to relate it to the tally marks for ones and read it after the 4, just as "three ones" was read after "four tens." Be sure to make clear that, when there are no ones, "0" is to be written in ones' place to show that there are none. Do not let the children say that the zero is written to show that the 4 is in the position that shows groups of 10. Tell them that the numeral written at the right has only one meaning even when it is a zero—it tells how many ones there are.

Introduce this page by drawing a response box on the board, writing numerals at the right, and using ob-

jects. Use piles or pyramids and single objects for the children to tally. Be sure that the number of objects is represented by one of the numerals on the board. If the work suggested in "Preliminary Teaching" has been done, one or two demonstrations of what the children are to do should be enough.

When they have finished, the children should compare and discuss their work.

## 79 Comments

On this page the children get more practice in tallying groups of 10 and ones and encircling numerals to show how many objects are represented by the tally marks.

The "Comments" for page 78 apply to this page also. The mechanics of the pages are the same, and they have the same objective. This part of the work on the numeral system is very important, and the children should have ample practice and plenty of time in which to do it.

Introduce this page by asking the children to tell what they are to do. Be sure they can read the numerals correctly.

When the children have finished the work, let them discuss and compare their answers.

## 80 Comments

On this page the children count groups of 10 and single objects and circle the blue numeral that shows the number of objects in the picture.

The final step in introducing the numeral system is made on this page. The children count groups of 10 and single objects and circle the numeral that tells how many there are in the picture, without the intervening step of tallying. The children now should be able to understand the numerals

under 100 well enough to select them without making the tally marks that tell them what digit should be in tens' place and what digit should be in ones' place. Being able to do this is a satisfactory accomplishment in the introductory phase of the numeral system.

Introduce this page by writing several numerals on the board. Use cards showing piles of 10 and single objects, or stack objects on a table as you did for previous pages. Ask the children to count the objects on the table or on the cards by tens and ones and select, without tallying, the numeral on the board that correctly tells the number they have counted. Let a child circle the numeral on the board. Change some of the numerals on the board each time the objects are changed, so that the children cannot choose them by elimination.

Be sure the children understand that the objects in the picture in the lower right corner of the page represent single pennies.

When they have completed the exercises, permit the children to compare and discuss their work.

# 74

1 The children should observe that all the objects on the page are arranged in groups of 10 and that there are 5 groups in each picture. [The numerals printed in the pictures of the reproduced page suggest numbers you might use.] Point to the top left picture. Have the children count piles of blocks by tens until they have counted 30 blocks. Then they should draw a line joining the tops of the piles they have counted.

2 For each picture, have the children proceed as in Note 1. Use the numeral printed in the upper left corner of each picture. When they count only one pile, tell them to draw a line at the top of the pile.

3 Using the numeral in the lower left corner of each picture, follow the procedure described in Note 1. This time have the children draw a line joining the piles at the bottom.

|                                                                                               |                         |
|-----------------------------------------------------------------------------------------------|-------------------------|
| 30<br>1<br><br>20<br>50                                                                       | 10<br><br>40            |
| 2<br><br>40                                                                                   | 20<br><br>50            |
| 40<br><br>30                                                                                  | 30<br><br>40            |
| 10<br>—<br>50<br><i>Other responses might be given. The ones shown are illustrative only.</i> | 20<br><br>30            |
| 40<br><br>20                                                                                  | 50<br><br>30            |
| 20<br><br>50                                                                                  | 30<br><br>20            |
| 30<br>40<br><br>40                                                                            | 10<br>—<br>50<br><br>50 |

# 75

1 Have the children note that the objects are arranged in groups of 10 and that there are 10 groups in each picture. Have them count aloud to 100 by tens several times, pointing to the piles of logs in the first picture. Then have the children count piles of logs by tens until they have counted 70 logs and draw a line joining the tops of the piles they have counted. Inspect their work.

2 Using the numeral in the upper right corner of each picture, have the children proceed as described in Note 1.

3 Using the numeral in the lower right corner of each picture, follow the procedure described in Note 1. This time have the children draw a line joining the piles at the bottom.

|                                                                                                           |
|-----------------------------------------------------------------------------------------------------------|
| <br>1 70<br>3 80                                                                                          |
| <br>2 50<br>60<br>90                                                                                      |
| <br>40<br>70                                                                                              |
| <br>30<br>40                                                                                              |
| <i>Other responses might be given. The ones shown are illustrative only.</i><br><br>60<br>80<br>90<br>100 |
| <br>30                                                                                                    |

|          |          |  |
|----------|----------|--|
| <p>1</p> | <p>2</p> |  |
|          |          |  |
|          |          |  |

1 Follow the procedure suggested in the paragraph beginning "Introduce the page . . ." under "Comments" on page 79 of this *Teaching Guide*. Then work through the first picture with the children. Tell them to make a tally mark on the *left* side of the response strip for each group of 10 in the picture, then to make a tally mark on the *right* side of the response strip for each single object in the picture. Examine their work.

2 Tell the children to follow the same procedure for each of the other pictures on the page. Let the children take turns reading their responses. Be sure they say something like "There are four marks for tens and three marks for ones."

|          |  |          |
|----------|--|----------|
| <p>1</p> |  |          |
|          |  |          |
|          |  | <p>2</p> |

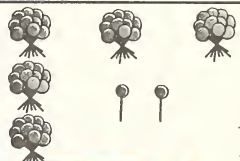
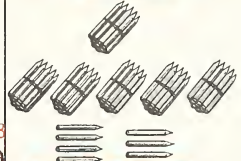
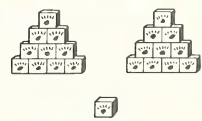
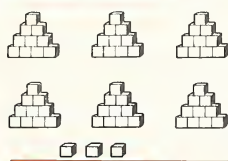
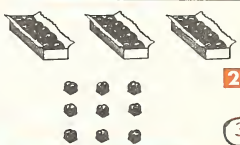
1 Point out that the pictures on this page are like those on page 76. Tell the children that for each picture they are to make a tally mark for each group of 10 to the *left* of the line in the response strip and a tally mark for each single object to the *right* of the line.

2 Let the children take turns reading their responses in the same way they did for the work on page 76.

# 78

1 Ask the children to make tally marks for the objects in the pictures in the same way they tallied objects on the preceding pages. Then have them count the tally marks to find how many groups of 10 and how many ones there are. Then they should encircle the blue numeral to the right of the strip that represents the tens and ones. Warn them that sometimes there might be two numerals that show the right numeral for the groups of 10 but that there is only one numeral that also shows the right numeral for the ones.

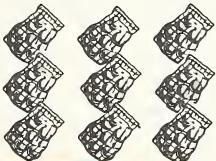
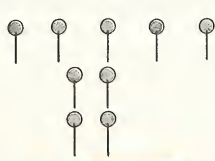
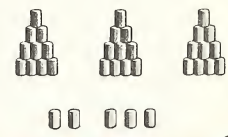
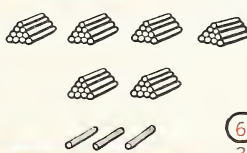
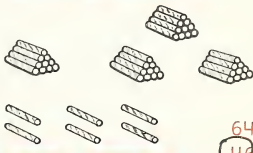
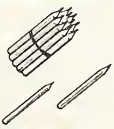
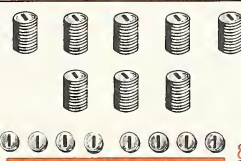
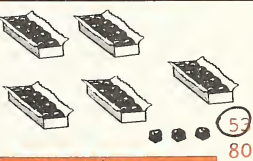
2 Let the children discuss their work. Be sure they can read the numerals correctly.

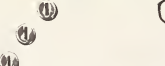
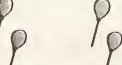
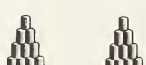
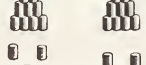
|                                                                                                                          |                                                                                                           |                                                                                                                         |
|--------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
|  <p><b>1</b></p> <p>40<br/>4<br/>31</p> |  <p>31<br/>13<br/>20</p> |  <p>70<br/>25<br/><b>52</b></p>       |
|  <p>58<br/>8<br/>81</p>                 |  <p>67<br/>66<br/>76</p> |  <p>3<br/>12<br/><b>2</b></p>         |
|  <p>63<br/>36<br/>9</p>                 |  <p>52<br/>70<br/>7</p>  |  <p><b>2</b><br/>39<br/>93<br/>60</p> |

# 79

1 Tell the children to make tally marks for the groups of 10 and the single objects in each picture. Then they should encircle the blue numeral that shows how many objects the tally marks stand for in the same way they did on page 78.

2 Let the children discuss their work.

|                                                                                                                           |                                                                                                            |                                                                                                                           |
|---------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
|  <p><b>1</b></p> <p>9<br/>90<br/>54</p> |  <p>9<br/>90<br/>54</p>  |  <p>53<br/>39<br/>32</p>               |
|  <p>63<br/>36<br/>90</p>               |  <p>11<br/>1<br/>10</p> |  <p>64<br/>46<br/>40</p>              |
|  <p>30<br/>21<br/><b>17</b></p>        |  <p>8<br/>80<br/>89</p> |  <p><b>2</b><br/>53<br/>80<br/>35</p> |

|                                                                                                                                                                                       |                                                                                                                                                                                          |                                                                                                                                                                                         |                                                                                                                                                                                          |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br><br>41<br>5<br>14 | <br><br>22<br>40<br>4  | <br><br>52<br>25<br>7 | <br><br>81<br>18<br>9  |
| <br><br>6<br>60<br>16 | <br><br>73<br>37<br>10 | <br><br>34<br>70<br>7 | <br><br>73<br>37<br>30 |
| <br><br>30<br>3<br>13 | <br><br>61<br>7<br>16  | <br><br>9<br>54<br>45 | <br><br>8<br>44<br>80  |

1 Get the children to observe that there are no tally strips for tallying groups of 10 and single objects in the pictures on this page. Tell them they are to count the groups of 10 and single objects and encircle the blue numeral that represents the number of objects.

2 When the children have finished, let them discuss their work.

## 81-85 PENNIES, NICKELS, AND DIMES

### Objectives

In the work on pages 81-85 the children begin to apply their ideas of number to money.

The formal application of these ideas to money begins with a knowledge of the names of the smaller coins—penny, nickel, and dime. It includes not only an understanding of the value of these coins and the relationships among them (that is, the equivalent values of the coins), but also some understanding of what each coin, or equivalent coins, will buy. The children must learn that a nickel is equal to five pennies, and that if a penny will buy one piece of candy, a nickel will buy five pieces, and a dime will buy ten. This section of the work is of fundamental importance, since one of the main uses of number

ideas in daily life is dealing with money.

### Preliminary Teaching

Before using Worksheets 81-85, the children must learn to identify pennies, nickels, and dimes; they must learn that one cent is the same as one penny, that five cents are equal to a nickel, that ten cents are equal to a dime, and that two nickels are equal to a dime.

Each child should have two markers for each number 0 to 9, and two or three markers with the cent sign (¢). You should also have available some real pennies, nickels, and dimes. Any substitute for real coins is unsatisfactory, since a great part of learning to identify coins, to count them, and to make change depends

upon familiarity with the coins themselves—their feel, appearance, size, etc. If possible, have at least 10 dimes, 20 nickels, and 100 pennies. If the children can bring coins from home, have each child bring 2 dimes, 2 nickels, and 10 pennies. If it is impossible to provide real coins for the children to work with, use toy money, but use it only as a last resort.

First, show the children dimes and pennies, and be sure they can name and identify the coins. Be sure they know that the terms "cent" and "penny" are interchangeable. Let them talk about the money they have to spend and how they spend it. Ask how much familiar things such as candy, ice-cream cones, pencils, etc., cost. Let the children set up a store on a table in front of the room and pretend to buy pencils. Have a quantity of pencils or peg sticks, and tell

the children they cost a penny apiece. Let the children take turns buying pencils. Control this activity by selling the pencils yourself, and by giving the children only pennies and dimes to pay for them. Let them buy any number of pencils up to 20, and have them count out the exact amount of money. When a child buys 10 pencils and pays for them with 10 pennies, ask if some other coin could be used get them to say "a dime"). If they pay with a dime, ask the same question, and get them to say "10 pennies." Be sure they understand that a dime equals 10 pennies and that 10 pennies will buy the same number of pencils as a dime. Next, show them how to count coins amounting to more than 10 cents by using a dime and pennies. Be sure they know they can pay 13¢, for example, for either 13 pennies or a dime and 3 pennies.

Next, draw several circles on the board and write "10¢" in the first one and "1¢" in the others. Tell the children to count the money you have drawn on the board and to show how much it is with their numeral markers and their cent signs. Watch to see that they always put the cent sign marker after the numeral markers. This activity can be performed with real coins if you can work with a group small enough so you can see the coins as they are put down. As with all activities in this part of the work, it is better to use real coins.

Next, make stacks of 10 pennies, and show the children how to count them by tens. Be sure they always say "cents" after the number ("ten cents," "twenty cents," "thirty cents"). Now show them how to count amounts like thirty-six cents by saying "ten cents, twenty cents, thirty cents, thirty-one cents, thirty-two cents, thirty-three cents, thirty-four cents, thirty-five cents, thirty-six cents" as they point to piles of pennies and

single pennies. Put a dime in place of one of the piles of pennies, and ask another child to count it in the same way. Continue with different amounts of money and all possible situations involving dimes and pennies. Let the children show with numeral markers how much money there is.

[Worksheets 81 and 82 can be used at this point.]

Repeat the activities suggested in the preceding section, this time using pennies, nickels, and dimes. First show the children nickels and pennies, and be sure they can recognize and name the nickel. Tell them that one nickel will buy the same amount as 5 pennies. Be sure they know they can call a nickel "five cents." Let them count out 5 pennies and put a nickel beside them. Show them how to count to 10 by pointing to the nickel and saying "5 cents," then pointing to the pennies one by one and saying "6 cents, 7 cents, 8 cents, 9 cents, 10 cents." Repeat this procedure several times, counting to different amounts up to 10 cents, and have them count to 10 using only pennies a few times.

Let the children discuss what they can buy with a nickel, with a nickel and 5 pennies, with 2 nickels, and with 10 pennies. Ask them how many pennies are equal to a dime. Count out 10 pennies, then ask one of the children to separate the 10 pennies into two groups of 5 pennies each and put down a nickel for each group of 5 pennies. Get them to say that 2 nickels are also equal to one dime. Make a stack of 10 pennies, remove 5 pennies and substitute a nickel, and let the children count the money. Then take away the remaining 5 pennies and substitute another nickel. Be sure they understand that there is still 10¢ in the pile. Repeat this procedure with nickels and pennies until the

children show that they know the value of a nickel is equal to 5 pennies and that 2 nickels are equal to the value of a dime.

Adapt the pencil-buying activity described in the preceding section to pennies, nickels, and dimes. Let the children buy pencils and count out the money to pay for them. Show them how to make change for a nickel or a dime. Ask "If you bought 7 pencils and paid for them with a dime, would you get any money back?" Show them how to count change by saying "8 cents, 9 cents, 10 cents" as you push 3 pennies forward, one by one. Explain that 7 cents is the part of the dime that the person selling pencils is going to keep for the pencils, and that the "8 cents, 9 cents, 10 cents" is the rest of the dime that the buyer gets back. Let the children make change for a nickel or a dime until they understand the principle.

Let them practice counting various combinations of pennies, nickels, and dimes in amounts up to twenty cents. You can use circles on the board marked 10¢, 5¢, 1¢, or you might use real coins for a small group. Let the children count the pennies, nickels, and dimes and show the amount with markers. Be sure they always put the cent sign after the numeral that shows the amount.

Show the children how to combine nickels, nickels and pennies, and pennies to make stacks of 10¢, and let them count the money by tens. Show them various amounts of money up to fifty cents in stacks of 10¢ and made up of different combinations of coins. Let them count this money and show the amounts with their markers.

Finally, let them discuss various things they might buy that would cost 20¢ or less, and let them show with coins how they would pay.

[Worksheets 83, 84, and 85 can be used at this point.]

## 81 Comments

On this page the children learn that 10 pennies and one dime are equal in value and will buy the same things.

Experiences with money that are to have any meaning for the children must be real, not abstract. Even on the pages of this workbook, where money must necessarily be symbolized in pictures, the situations with which the child is asked to deal are like those he deals with outside the classroom. That is, the things he is pretending by buy are things he would normally buy, and the coins he is pretending to use are coins he might often have in his possession.

The comparative values of pennies, dimes, and nickels are introduced step by step, until the children are acquainted with them and are able to use them interchangeably.

On page 81 the work in this section is begun with pennies and dimes. The children learn the comparative values of these coins and get some idea of what they can buy for 20¢ or less.

Introduce this page by putting a few small toys with price tags beside them on a table. Put a few dimes and about 20 pennies on the table, and let the children take turns selecting the coins they would use to buy one of the toys.

When they have finished the work on Worksheet 81, have them compare and discuss their answers.

## 82 Comments

On this page the children get more experience in counting pennies or pennies and dimes, and in selecting combinations of coins that make amounts of 20¢ or less.

Introduce the page by asking the children to examine it and tell what they think they are to do.

When they have finished the work on the page, have them compare and discuss their responses.

## 83 Comments

On this page the children learn that five pennies and one nickel are equal in value and will buy the same things.

Having had some experience with the equivalent value of ten pennies and one dime, the children go on to select combinations of nickels and pennies to make up amounts of ten cents or less. They learn to use five pennies or one nickel interchangeably, and to use two nickels for ten cents. They also get some idea of what they might be able to buy for a dime or less.

Introduce this page in the same way you introduced page 81. Put some toys and other small articles on the table with tags showing prices of 10¢ or less beside them. Let the children take turns selecting from an assortment of pennies and nickels the coins they would use to buy the objects. Be sure they understand they can use a nickel instead of five pennies.

When the children have finished the work on the page, let them compare and discuss their responses.

## 84 Comments

On this page the children learn that ten pennies, two nickels, and one dime are equal in value and will buy the same things.

The next step beyond learning that ten pennies and one dime are equal, and that five pennies and one nickel are equal, is learning that two nickels and one dime are equal. The children now select combinations of pennies, nickels, and dimes to make up amounts of twenty cents or less. They also get more experience in finding

out the sort of things they might be able to buy for 20¢ or less.

Introduce the page by asking the children to tell what coins they could use to buy things that cost 16¢, 11¢, 9¢, 18¢, etc. Draw the coins on the board as the children name them (use circles with 1, 5, or 10 on them), and ask the other children to count the coins to be sure they make up the right amount.

When the children have finished the work on the page, let them compare and discuss their answers.

## 85 Comments

On this page the children get further experience in selecting coins that make up amounts of money needed to buy various objects for which the prices are given.

This is the final exercise in this series of pages. By now the children should know the equivalent values of pennies, nickels, and dimes and have some idea of what they could buy with small amounts of money and how to select combinations of coins to make up desired amounts. As on the other pages, the amounts of money with which the children work are 20¢ or less.

Introduce this page by explaining to the children that it is similar to the other pages about money. Ask them to look at the page and tell what they think they are to do. Encourage them to use as many variations of coins as possible for each picture.

When they have finished the work, let them compare and discuss their responses.

# 81

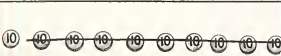
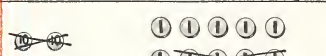
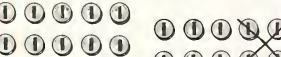
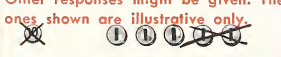
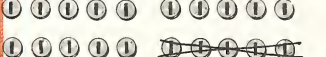
1 Let the children discuss the toys in the red pictures. Get someone to say that the price tag with each toy tells how much the toy costs. Call attention to the airplane and its price tag.

2 Tell the children that the coins with "1" on them stand for pennies. Have them count enough pennies in this section to buy the airplane and cross off the remaining coins.

3 Tell the children that the coins with "10" on them stand for dimes. Have them count enough dimes and pennies in this section to buy the airplane and cross off the remaining coins.

4 Have the children follow the same procedure for each picture and its two sets of coins.

5 Let the children discuss their answers and correct their work.

|                                                                                                                                                                        |                                                                                                                                                                        |                                                                                                                                                                        |                                                                                                                                                                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br> | <br> | <br> | <br> |
| <br> | <br> | <br> | <br> |
| <br> | <br> | <br> | <br> |
| <br> | <br> | <br> | <br> |

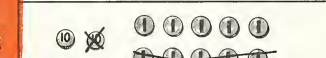
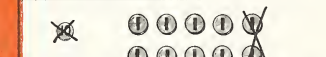
Other responses might be given. The ones shown are illustrative only.

# 82

Direct attention to the first picture. Remind the children that the coins with "1" on them stand for pennies and the coins with "10" on them stand for dimes. In each of the sections of the picture that shows coins, have them select the coins they would use to buy the telephone and cross off the coins they would not need.

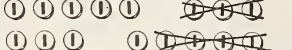
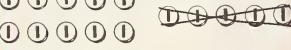
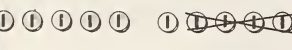
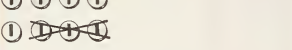
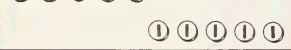
Have the children follow the same procedure for each picture on the page.

Let the children discuss and correct their work.

|                                                                                                                                                                            |                                                                                                                                                                            |                                                                                                                                                                            |                                                                                                                                                                              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br>    | <br>    | <br>    | <br>    |
| <br> | <br> | <br> | <br> |
| <br> | <br> | <br> | <br> |
| <br> | <br> | <br> | <br> |

Other responses might be given. The ones shown are illustrative only.

# 83

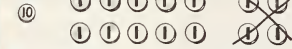
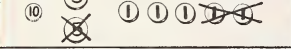
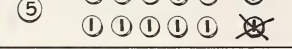
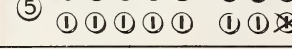
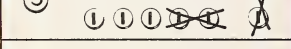
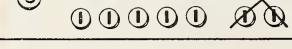
|                                                                                                     |                                                                                          |                                                                                         |                                                                                        |
|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| <br><b>1</b><br>5¢  | <br>5   | <br>9¢ | <br>5 |
| <br><b>2</b><br>10¢ | <br>5 5 | <br>6¢ | <br>5 |
| <br>7¢              | <br>5   | <br>5¢ | <br>5 |
| <br>10¢             | <br>5   | <br>8¢ | <br>5 |

1 Direct attention to the picture of the paper cup of ice cream and the coins. Tell the children that the coins with "1" on them stand for pennies and the coins with "5" on them stand for nickels. For each section of coins, have them select those they would use to buy the ice cream and cross off the others.

2 Tell the children to follow the same procedure for each picture on the page.

3 Let the children discuss and correct their work.

# 84

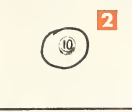
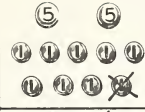
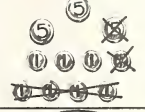
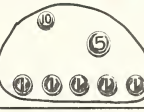
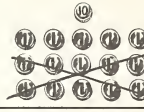
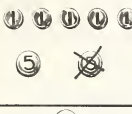
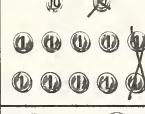
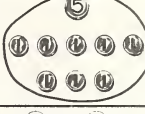
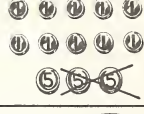
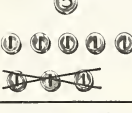
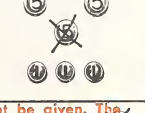
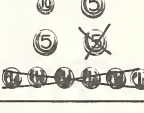
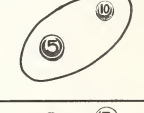
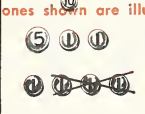
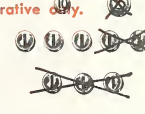
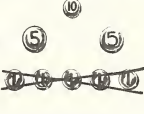
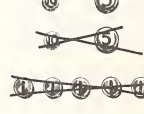
|                                                                                                       |                                                                                           |                                                                                            |                                                                                          |
|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| <br><b>1</b><br>15¢   | <br>10   | <br>20¢   | <br>10  |
| <br><b>2</b><br>18¢ | <br>10 | <br>16¢ | <br>5 |
| <br>11¢             | <br>10 | <br>20¢ | <br>5 |
| <br>13¢             | <br>5  | <br>15¢ | <br>5 |

1 Direct attention to the first picture. Remind the children that the coins with "1" on them stand for pennies, the coins with "10" on them stand for dimes, and the coins with "5" on them stand for nickels. Ask them to select the coins in each of the two sections of coins that they would use to pay for the soda and to cross off the coins they would not need.

2 Have the children follow the same procedure for each picture.

3 Let the children discuss their work and correct it.

- 1 Have the children look at the picture of the balloon and notice how much the balloon costs.
- 2 Ask the children to look at the four pictures of money that are shown below the balloon. Tell them that for each picture they are to count enough money to buy the balloon and cross off the coins that are not needed. If there is just enough money to buy the balloon, they are to draw a circle around the coin or coins.
- 3 Have the children follow the same procedure for this picture and the four pictures of coins below.
- 4 Let the children discuss and correct their work.

|                                                                                       |                                                                                       |                                                                                       |                                                                                        |                                                                                         |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
|  10¢ |  18¢ |  13¢ |  20¢ |  15¢ |
|      |      |      |      |      |
|      |      |      |      |      |
|      |      |      |      |      |
|      |      |      |      |  4   |

Other responses might be given. The ones shown are illustrative only.

## 86-96 REVIEW

### Objectives

The final section of *Our Number Workshop 1* consists of eleven pages of review. These worksheets provide further practice on the concepts and skills developed during the year.

The work done on Worksheets 86-96 may be used to evaluate the children's understanding of number concepts and to indicate the areas in which individual children need help. If it is feasible, a summary of the achievement of each child should be recorded for use the following year.

### Preliminary Teaching

Since Worksheets 86-96 deal with ideas that have already been introduced, no preliminary teaching is necessary.

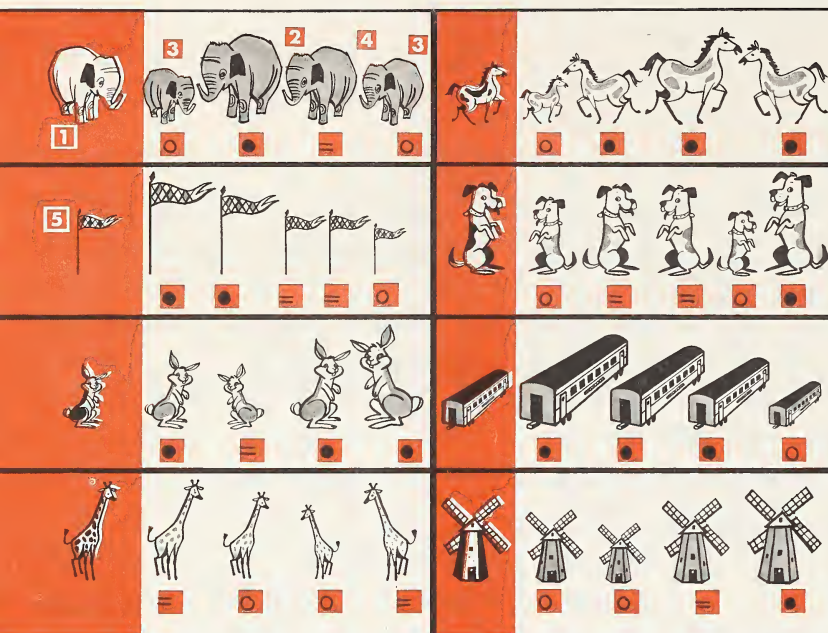
### Comments

These review pages cover the following ideas: concepts of size (Worksheet 86), recognition of groups of 3 to 10 (Worksheets 87-88), combining subgroups to make groups of 4 to 10 (Worksheets 89-90), measurement using a standard unit (Worksheets 91-92), measurement of capacity (Worksheet 93), number symbols to 100 (Worksheet 94), and counting money—nickels, dimes, and pennies (Worksheet 95). Worksheet 96 is a puzzle that is based on recognition of groups of 1 to 10. The children look for numerals hidden in pictures of toys.

With the exception of Worksheet 96, which is unlike any other page in *Our Number Workshop 1*, all the exercises follow familiar patterns. Each page should be introduced by asking

the children what they think they are to do with it and by letting them discuss briefly the concept dealt with on the page. For the most efficient use of this review section, the class should be divided into small groups so that the teacher can observe each child. Any concepts the children have difficulty with should, ideally, be re-taught at this time. The "Preliminary Teaching" notes for the worksheets on which the concepts were introduced may be used for this purpose.

This review will determine whether each child is working with a group whose level of achievement is consistent with his own, and will provide the teacher with useful criteria for planning the work and group placement the following year.



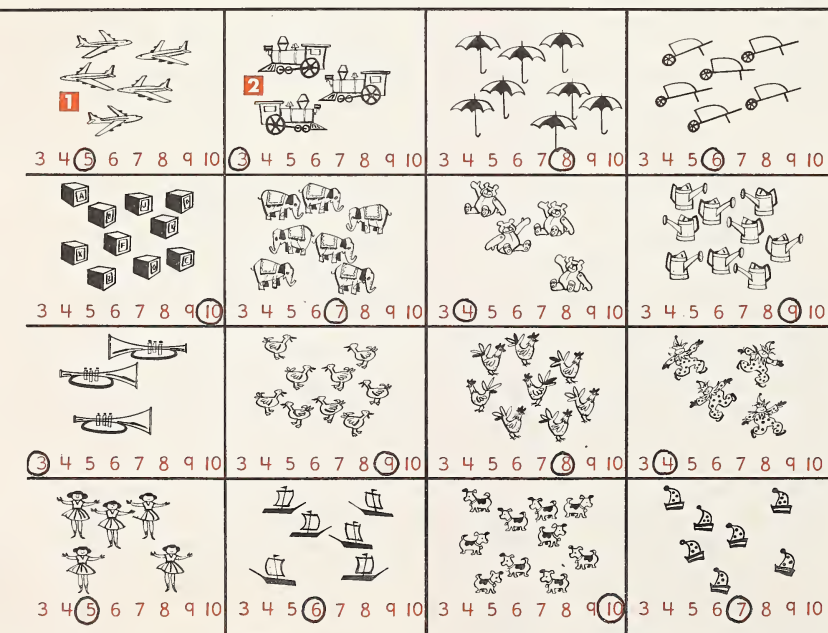
1 Direct attention to the elephant in the red part of the first picture.

2 Ask the children to find all the elephants that are larger than the key elephant and to put the mark ● in the red squares under them.

3 Have the children find all the elephants that are smaller than the key elephant and put the mark ○ in the red squares under them.

4 Now have the children find an elephant that is the same size as the key elephant and put the mark = in the red square.

5 Ask the children to use the same procedure for each key picture in each red section on the page. Remind them that there may be more than one animal (or object) that is larger, smaller, or the same size as the key animal (or object).



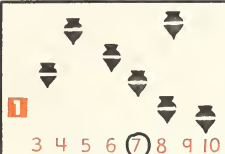
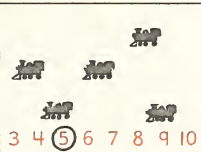
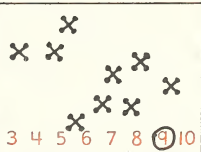
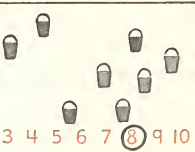
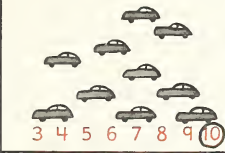
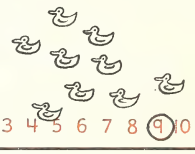
1 Direct attention to the first picture. Ask the children to decide, without counting, how many airplanes there are. Then have them find among the red numerals below the picture the numeral that represents the number of airplanes and encircle it.

2 Ask the children to follow the same procedure for each picture on the page.

# 88

1 Direct attention to the first picture. Ask the children to decide, without counting, how many tops there are. Then have them find among the red numerals below the picture the numeral that represents the number of tops and encircle it.

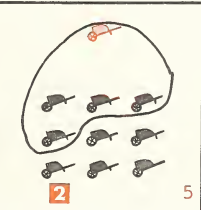
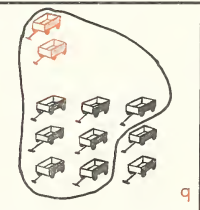
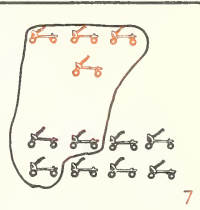
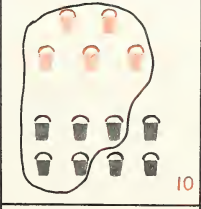
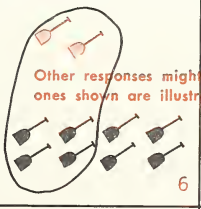
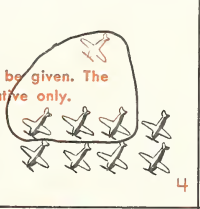
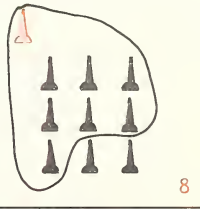
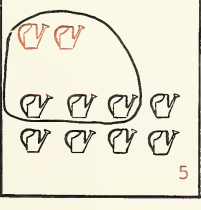
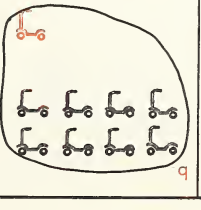
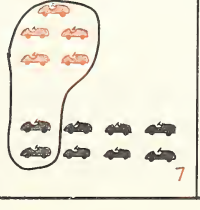
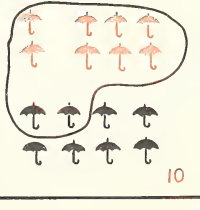
2 Ask the children to follow the same procedure for each picture on the page.

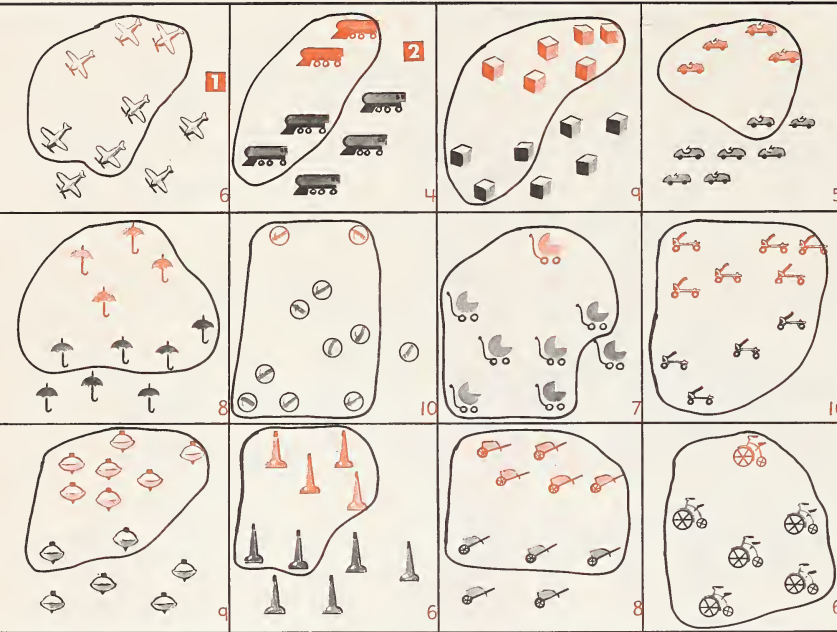
|                                                                                                             |                                                                                                             |                                                                                                            |                                                                                                             |
|-------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
|  <p>1 3 4 5 6 7 8 9 10</p> |  <p>2 3 4 5 6 7 8 9 10</p> |  <p>3 4 5 6 7 8 9 10</p> |  <p>3 4 5 6 7 8 9 10</p> |
|  <p>3 4 5 6 7 8 9 10</p>   |  <p>3 4 5 6 7 8 9 10</p>   |  <p>3 4 5 6 7 8 9 10</p> |  <p>3 4 5 6 7 8 9 10</p> |
|  <p>3 4 5 6 7 8 9 10</p>   |  <p>3 4 5 6 7 8 9 10</p>   |  <p>3 4 5 6 7 8 9 10</p> |  <p>3 4 5 6 7 8 9 10</p> |
|  <p>3 4 5 6 7 8 9 10</p>   |  <p>3 4 5 6 7 8 9 10</p>   |  <p>3 4 5 6 7 8 9 10</p> |  <p>3 4 5 6 7 8 9 10</p> |

# 89

1 Direct attention to the red numeral in the lower right corner of the first picture. Tell the children that they are to make a group of 8 by drawing a ring around all the red boats and enough of the black boats to make 8.

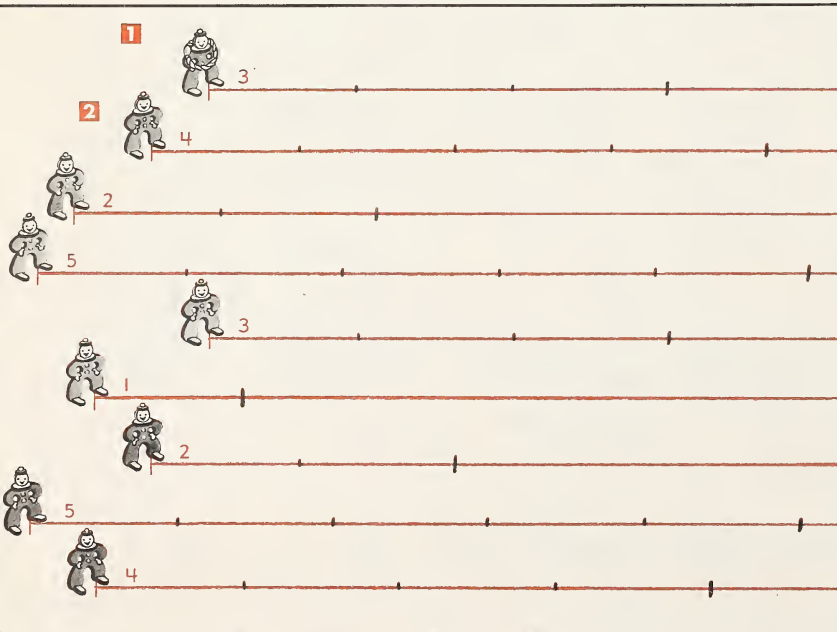
2 Ask the children to follow the same procedure for each picture on the page. The red numeral tells how many toys they are to encircle in each picture. Remind them that they must use all the red toys in each picture.

|                                                                                               |                                                                                                                                                                        |                                                                                                |                                                                                                 |
|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
|  <p>1 8</p> |  <p>2 5</p>                                                                          |  <p>q 9</p> |  <p>7</p>   |
|  <p>10</p> |  <p>Other responses might be given. The ones shown are illustrative only.<br/>6</p> |  <p>4</p>  |  <p>8</p>  |
|  <p>5</p>  |  <p>q 9</p>                                                                         |  <p>7</p>  |  <p>10</p> |



1 Direct attention to the red numeral in the first picture. Tell the children that they are to draw a ring around all the red planes and enough of the black planes to make the group indicated by the numeral.

2 For each picture have the children note the red numeral and draw a ring around the specified number of toys. Remind them that they must use all the red toys in each picture.



1 Give each child a 2-inch stick. Direct attention to the red numeral 3 on the top line. This numeral indicates the number of times the stick is to be used for measuring. Tell the children to lay the stick on the line so that one end touches the red mark by the clown's foot, then to make a little mark at the other end of the stick. Tell them to pick up the stick and lay it down again so that one end touches the mark they made, then to make another mark at the other end of the stick. Have them repeat this procedure once more.

2 Ask the children to follow the same procedure for the other lines on the page. Remind them that the red numeral at the beginning of the line tells them how many times to put down the stick.

# 92

1 Give each child a 2-inch stick. Tell the children to measure the red line in the first picture by laying the stick down so that one end touches the red mark at the beginning of the line, making a mark at the end of the stick, and laying the stick down again until the end of the line is reached.

2 Have the children notice the red numerals above the red line. Tell them to encircle the numeral that tells how many sticks long the line is. If the red line is a little longer than a number of sticks, they should fill in the ring. If the line is not quite as long as a number of sticks, the ring should remain as it is.

3 Have the children measure the red line in each picture in the same way.

|   |                                                                                    |           |                                                                                     |
|---|------------------------------------------------------------------------------------|-----------|-------------------------------------------------------------------------------------|
| 1 |   | 1 2 3 4 5 |  |
| 2 |  |           |                                                                                     |
| 3 |   | 1 2 3 4 5 |  |
|   |  |           |                                                                                     |
|   |   | 1 2 3 4 5 |    |
|   |   | 1 2 3 4 5 |  |
|   |  |           |                                                                                     |
|   |   | 1 2 3 4 5 |  |
|   |  |           |                                                                                     |
|   |   | 1 2 3 4 5 |  |
|   |  |           |                                                                                     |

# 93

1 Tell the children they are to imagine they fill the containers in the picture with water and empty them into a pail as many times as the red marks above the containers indicate. If they think more water would be poured from one container, tell them to put the mark ● in the square under that container and put the mark ○ in the square under the other container. If they think the amount of water to be poured from each is the same, have them make the mark = in each square. If they cannot tell which container would have more water poured from it, have them make the mark ≡ in each square.

2 Ask the children to follow the same procedure for each picture on the page.

|   |                                                                                     |   |                                                                                     |                                                                                     |                                                                                       |
|---|-------------------------------------------------------------------------------------|---|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1 |   | 2 |   |  |   |
|   |    |   |    |                                                                                     |    |
|   |    |   |    |                                                                                     |    |
|   |  |   |  |                                                                                     |  |
|   |  |   |  |                                                                                     |  |
|   |  |   |  |                                                                                     |  |
|   |  |   |  |                                                                                     |  |
|   |  |   |  |                                                                                     |  |
|   |  |   |  |                                                                                     |  |
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|-------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
|  <p>1</p> <p>11<br/>92<br/>29</p> |  <p>2</p> <p>56<br/>50<br/>65</p> |  <p>51<br/>15<br/>60</p> |  <p>44<br/>80<br/>8</p> |
|  <p>12<br/>84<br/>48</p>          |  <p>10<br/>82<br/>28</p>          |  <p>34<br/>70<br/>7</p>  |  <p>6<br/>42<br/>60</p> |
|  <p>7<br/>70<br/>14</p>           |  <p>91<br/>19<br/>10</p>          |  <p>34<br/>43<br/>70</p> |  <p>11<br/>2<br/>20</p> |

1 Direct attention to the first picture. Remind the children that each pile represents 10 objects. Tell them to decide how many boxes in all there are in the picture, then to draw a ring around the red numeral that shows the correct number of objects.

2 Have the children follow the same procedure for each picture on the page.

|                                                                                                                 |                                                                                                        |
|-----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
|  <p>1</p> <p>10 1 1 1 1 1</p>   |  <p>5</p> <p>10 5</p> |
|  <p>2</p> <p>10 10</p>         |  <p>10</p>           |
|  <p>3</p> <p>5 1 1 1 1 1</p>  |  <p>5 1 1 1 1</p>   |
|  <p>5 5</p>                   |  <p>5 5 1 1</p>     |
|  <p>5 5</p> <p>10 1 1 1 1</p> |  <p>10 1</p>        |
|  <p>10 1 1 1 1 1</p>          |  <p>5 5</p>         |
|  <p>10 1 1 1 1 1</p>          |  <p>10 5 5</p>      |

1 Direct attention to the first picture and point out the red strip and the two white strips. Tell the children that if they think the coins in the top white strip would buy more than the coins in the red strip, they are to put the mark ● in the response square. If the coins in the white strip would buy less than those in the red strip, they are to put the mark ○ in the response square. If the coins in the white strip would buy the same amount as those in the red strip, they are to put the mark = in the square.

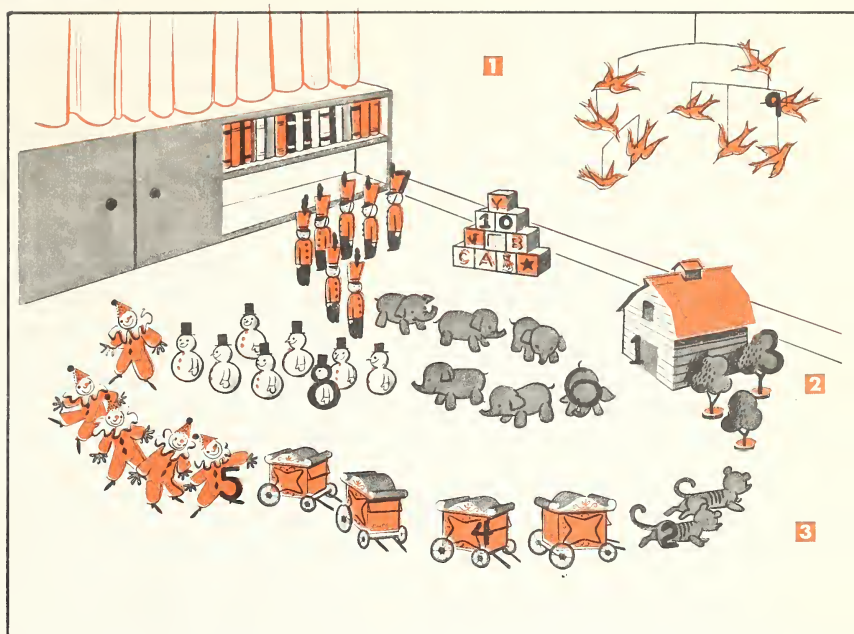
2 Have the children follow the same procedure for the other white strip.

3 Use Notes 1 and 2 for each picture on the page.

1 Tell the children that this picture is a puzzle in which they are to find groups of 1 to 10 toys. They are to decide how many toys are in a group, then find a hidden numeral that tells how many are in the group.

2 Have the children look at the toy trees. Ask them to decide how many trees there are, then to find the numeral that is hidden in the trees [3] and mark over it with a pencil or crayon.

3 Have the children follow the same procedure for each group of toys in the picture. Remind them that they should decide how many toys are in a group first, then find the hidden numeral.



(Continued from inside front cover)

The exercises in *Our Number Workshop 1* are different from those found in most primary arithmetic workbooks. This workbook is a laboratory in which the children work with the concepts they have been learning and in which their attention is always kept centered on number ideas. Every exercise makes a positive contribution to the child's cumulative learning. To insure the development of the number understandings to their fullest extent, each exercise has been carefully planned with strict adherence to the following criteria:

1 Each exercise gives constructive practice in the number ideas the child has been learning.

2 There is no extraneous material—no activities unconnected with arithmetic, no useless and time-consuming coloring, drawing, or pasting—to distract the child.

3 Individual differences are provided for. The exercises are challenging and interesting to the able children and still are within the abilities of the slow learners. The nature of each worksheet enables the teacher to give directions to groups of differing abilities, to allow a suitable amount of time for doing the work, and to judge the work of the children.

4 The exercises on all but a few worksheets are constructed so that when the page has been introduced and the instructions for doing the work have been given, the children will be able to complete the worksheet on their own. The teacher can then give assistance to the less able children.

5 The child must rely on his own judgment and knowledge to do the

work. Particular care has been taken to require meaningful answers—not mechanical, or rote, responses.

6 The exercises are planned so that the teacher can evaluate the responses quickly.

#### Provision for Individual Differences

For the children to benefit fully from *Our Number Workshop 1*, the teacher must be sure that she is using it as it is meant to be used. To take advantage of its adaptability to individual differences, the teacher should work with small groups of children of similar abilities. The teaching of the number ideas that takes place before the use of the exercises is also most effective when the teacher works with reasonably small groups. The exercises were planned so that the children could work independently, thus giving them confidence in their new knowledge and giving the teacher time to work with one group of children without neglecting another group.

An important part of teaching is to adapt the materials to the ability of the child. *Our Number Workshop 1* is designed to permit great flexibility in adapting the work to individual differences. For a superior group, the teacher may give two or more directions for doing the work on a worksheet and let the children complete the page independently. For a less able group, she may give one direction at a time, let the children make the responses required for this direction, and then give the direction for the next step.

*Our Number Workshop 1* makes possible another type of adaptation to individual differences. The less able groups need not complete in one class period all the work on a worksheet that requires more than one set

of responses. If such a group needs an entire class period to complete the first set of responses, the remainder of the work can be done on the following day, or the children can return to it later in the year. Worksheet 41 is an example of a page that can be used for several class sessions.

#### Response Technique

In *Our Number Workshop 1*, the child is required to make only five response marks. Not more than three of the marks are used on most of the worksheets. The response marks are: ● (a filled-in circle), which is used to indicate *many, most, tallest, largest, greatest quantity, etc.*; ○ (an open circle), which is used to indicate *few, less, shorter, shortest, smallest, least quantity, etc.*; =, which is used to indicate equality of size or amount; which is used to indicate *yes, this or etc.*; and the scribble mark (≡), which is used to indicate *no, not this, not many, cannot tell, etc.*

Each of the five response marks has a kinesthetic aspect and a connection with the meaning it expresses. The teacher should make sure that the connections are firmly established in the minds of the children. The mark for *few, little, least* (○) is open, empty, and easy to make. It requires less physical effort to make than the mark for *many, much, most* (●) because it is filled in and takes more time to make). The sign =, consisting as it does of two parallel lines, also suggests its meaning visually and kinesthetically. Its early use will provide a foundation on which to build the concept of equivalence, for which it is the traditional symbol. X, the mark for *this one, or here*, is already familiar through a variety of uses. The scribble mark (≡) is a natural symbol for *no, not this one, etc.*, since we instinctively scribble out words

(Continued on page 97)



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ograms, rather than mere conventional signs that would make a demand on the child's memory without contributing to his understanding. The child can make these symbols without interfering with his newly developed writing skills. He thus avoids the tensions that frequently arise when he is learning to write the number symbols. At this stage, the writing of number symbols is difficult and tedious, and, when done in connection with quantitative thinking, may block the development of the number concepts. Of course, the child will continue to learn to write the number symbols in situations in which the number symbols are not used to indicate responses.

On each worksheet on which the child is required to make any of the five response marks or to make tally marks, a colored square or strip has been provided for each response. The teacher can quickly check such responses by making a transparent overlay, including the correct responses, for each worksheet. On other worksheets the child is asked to join objects by a line, to encircle number symbols, or to mark off lengths on a line. All these markings are simple to make, and all are meaningful to the child.

For the type of worksheet on which the child is asked to form groups by encircling objects, as well as for the first three worksheets in the *Workshop* on which he is making decisions about *many* and *few*, the children's responses will vary. Since it is not feasible to show all the alternative answers, those shown on the reproduced pages are typical only. Each child's work should be evaluated in terms of his ability to follow directions and to show by his responses that he understands the ideas presented.

suggestions for checking  
hat may be used with the  
s of exercises are made

in the teaching notes in this *Teaching Guide*. When the teacher has become familiar with the *Workshop*, she will undoubtedly develop her own methods of evaluation for most of the exercises.

Drawing is used as a means of indicating response on only two worksheets (18 and 41).

### Teaching Considerations

When the preliminary teaching has been done, as outlined in this *Teaching Guide*, the procedure for using a worksheet should be somewhat as follows. The teacher allows the children to examine the page for a few minutes, then directs their attention to the first picture. She explains what they are to find and how the answers are to be indicated. When the children have done the work for the first picture, the teacher inspects each child's work and gives assistance to those who need it. The children then finish the page independently.

The only special equipment required for the work in *Our Number Workshop 1* is a supply of 2-inch sticks for use in the exercises on linear measurement (Worksheets 33-37 and 91-92). For all the other worksheets, only soft pencils (or crayons) and markers are needed.

Since the modern approach to number is the recognition of groups, the size of the pictures was carefully planned so that the child can see an entire group with a single eye movement. The use of larger pictures would defeat this method of teaching and would force him to count, rather than recognize, the groups.

Color is used in a functional way, rather than in a merely decorative way. One type of functional use of color may be observed on Worksheets

2, 3, 9, 51, and 76, on which colored squares or strips indicate the places where the child is to write his responses. Another functional use of color is illustrated on Worksheets 6, 10, 13, and 20, on which key objects that are to be matched, combined, or compared with other objects on the worksheet appear in color or on colored backgrounds.

While all the exercises in *Our Number Workshop 1* were carefully written and checked and are well within the abilities of most first-grade children, the teacher may occasionally wish to delay using a worksheet because she feels it is too difficult for a particular group of children at the point of first teaching. Such an exercise should be used later in the year when those children are better equipped to handle it.

Whenever possible, the teacher should help the children to discover their errors and to correct their own work. The children should be made to feel that discovering and correcting errors is a part of learning, not a sign of failure.

Only activities that develop number concepts have been used in *Our Number Workshop 1*; the type of activity in each exercise has been related to the concept. Great care has been taken to keep the responses simple and to avoid all activities that would set up blocks to the learning of arithmetic. While variety has been provided within the framework of the exercises, the number of different types of exercises is small, so that the child uses over and over again techniques with which he is already familiar.

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